

The influences of a primitive reflex integration programme within the classroom: Teacher/parent perspectives and student results.



**A thesis submitted in partial fulfilment of the requirement for the degree of
Doctor of Philosophy in Education**

by

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This thesis has not been submitted, in part or as a whole, for another degree at this or any other university.

Approval to conduct the research presented in this thesis was gained from the University of Canterbury Educational Research Human Ethics Committee.

Pseudonyms have been used for all participants: schools and individuals.

The quotations in Chapters 4 and 5 have been reproduced from transcriptions. Speech disfluencies and superfluous speech such as repetitions have been deleted to add clarity while maintaining intended meaning.

Abstract

The birth of a human is facilitated by primitive reflexes which assist with the infant's survival. Once the reflexes have been engaged, they then integrate and cognition takes over the functions needed to survive and thrive. Typically this process is completed within the first year of life. However, for some people, the primitive reflex integration process is interrupted, varying degrees of immaturity may persist and this may be associated with delays in skill acquisition. Movement-based interventions have been developed to assist the integration process. This thesis focuses on the phenomenon of primitive reflexes and the use of one reflex integration programme: Rhythmic Movement Training, with an aim of addressing the research question 'What influences does the use of Rhythmic Movement Training (RMT) have in a classroom?' The mixed methods methodology allowed the complexity of the issue to be explored hermeneutically and statistically. Ninety-eight New Zealand children, divided into two groups, intervention and control, used the RMT movements for between five and ten months. Seven teachers and 26 parents were interviewed and test results relating to the children's reflex profiles, Draw-A-Person Test, Reading, Writing, Mathematics and the Strengths and Difficulties Questionnaire were analysed. The findings and results of this thesis are organised around three emergent themes: the classroom, student achievement and student behavioural outcomes. The intervention's focus on the 'whole child' was seen as a strength and recommendations for further research are made to extend what is known about how and why primitive reflex integration enhances children's development. The teachers found the generic RMT programme easy to use with their children and they noticed positive changes in focus, achievement and self-worth. Statistically significant differences were detected in student reflex profiles, reading scores, social and emotional challenge scores when RMT was used four or more times each week for five months. This research also found that there were gains noted by teachers and parents, and improved results for children when they were engaged in this reflex integration programme using generic movements for five minutes per day, four or more times a week for five months.

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My success should not be bestowed on to me alone, as it was not individual success but the success of a collective.



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Proverbs retrieved from Woodward Ltd (2017) <http://www.maori.cl/Proverbs.htm>

List of Abbreviations

ADD	Attention Deficit Disorder
ADHD	Attention Deficit Hyperactivity Disorder
ASD	Autistic Spectrum Disorder
ATNR	Asymmetric Tonic Neck Reflex
DAP	Draw-A-Person test
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, 4th Edition
DST	Dyslexia Screening Test
EBP	Evidence-Based Practises
EBSCO	Elton B. Stephens Co (information discovery service)
ECE	Early Childhood Education
EDA	Exploratory Data Analysis
ERHEC	Educational Research Human Ethics Committee
FPR	Fear Paralysis Reflex
ILE	Innovative Learning Environment
INPP	The Institute of Neuro-Physiological Psychology
IQ	Intelligence Quotient
M-ABC	Movement Assessment Battery for Children
MNRI [®]	Masgutova Neurosensorimotor Reflex Integration
MKO	More Knowledgeable Other
NMT	Neurosequential Model of Therapeutics
PPCT	Process-person-context-time (Bronfenbrenner Theory of Development)
QRI	Quantum Reflex Integration
<i>r</i>	Correlation (a statistical test)
RMT	Rhythmic Movement Training
SES	Socio-economic Status
STNR	Symmetric Tonic Neck Reflex
TINE	Touwen Infant Neurological Examination
TLR	Tonic Neck Labyrinthine Reflex
UC	University of Canterbury, New Zealand
UP	Unlocking Potential – Sensory-motor Programme
WRAT	Wide Range Achievement Test
ZPD	Zone of Proximal Development

Chapter 1 Introduction

1.1 Why Research Retained Primitive Reflexes?

A typical New Zealand classroom of 2017 has a full curriculum and expectations from the Ministry of Education that teachers will provide children with the best learning opportunities available (as cited in Ministry of Education, 2007, p. 87). Teachers assess the value and benefit of each activity they engage in, and they assess the children's progress both academically and behaviourally. When there are achievement or behavioural challenges, schools are expected to work to meet the needs of the child and where possible, resolve the challenges (Ministry of Education, 2018). It is common in education for schools and government agencies to use evidence-based practices (EBP) to address learning and behavioural issues (Braden & Shernoff, 2008). Interventions considered EBPs have been assessed using research based on systematic evaluation to determine efficacy, or have undergone assessments in their typical settings, e.g. school or home, in an attempt to determine effectiveness (Braden & Shernoff, 2008). Finally, transportability is considered an important factor: Can the intervention move from the 'laboratory' to a classroom setting? How will the training work and what supervision is required? The role of a researcher interested in EBPs is to continue to search for interventions that pass efficacy, effectiveness and transportability tests.

The range of EBPs in Mather and Morris' (2008) book *Evidence-based interventions for students with learning and behavioural challenges* focus on assessment and then remedial intervention based on skill deficit. This is accepted as best-practice in educational settings (Braden & Shernoff, 2008; Dehn, 2008; Fahey, 2008; Mather & Urso, 2008; Schoenfield & Morris, 2008). In New Zealand, the widely used Reading Recovery programme (Ministry of Education, 2014) is based on skill deficit, with individualised reading tuition provided during the school day. While these programmes are EBPs, they require funding and take time out of the child's normal curriculum programme. This deficit model is being contested as the most effective model for intervention, with the Australian government changing their focus to teacher education and effective teaching strategies for all children rather than a focus on identifying 'discrepant achievement' (Graham & Bailey, 2007).

Another approach to learning and behavioural challenges puts underlying causes in focus. It may be parenting skills that are the target such as in the Triple P Programme (National Registry of Evidence-based Programs and Practices (NREPP), 2013; Sanders, Markie-Dadds, & Tully, 2000), or nutritional deficits (Rucklidge et al., 2012) that are addressed. However, in this research, the possibility that a child's neurological health, in particular any retained primitive reflexes, may be the basis for some skill immaturities is in focus. What are primitive reflexes? What is their typical progression and what interrupts the process? What happens to skill acquisition when a reflex-integration intervention is used? And how transportable is that intervention? These are some of the questions that are explored in this research thesis.

If retained primitive reflexes are associated with a range of learning and behavioural challenges as is presented in Chapter 2, and the intervention used in this research changes student outcomes as presented in Chapters 4 and 5, there are important implications. The self-worth of children can be compromised when they are struggling with achievement and behavioural expectations. They may take more time to make progress or need to practise tasks longer than others to achieve similar outcomes. For some children the appropriate intervention may increase their self-worth; it could reduce the time they take to achieve goals and improve their school experience. Another flow-on effect is the possibility that teachers may find more students make progress easily, thus improving their professional goals and possibly their job satisfaction. This research has been designed to assess student outcomes while acknowledging the important role of the teacher when the intervention is used in a classroom.

1.2 General Aim of this Research

The general aim of this research was to explore the use of a primitive reflex integration programme, Rhythmic Movement Training (RMT), in classrooms while assessing a range of measurable student outcomes. The group of participants came from typical mixed-ability New Zealand classrooms. Developing understanding relating to the use of RMT in a classroom setting was of interest because it was viewed as an easy intervention that may benefit children who would not normally receive individualised remediation. Many children do not reach the threshold of skill deficit to qualify for state-funded intervention (Graham & Bailey, 2007) and the generic use of RMT in this research is viewed as a cost-effective strategy based on teacher education

rather than individualised sessions for the child. Data was gathered from teachers and parents to extend the understanding of ‘lived experiences’ in relation to RMT. This research is primarily about the experience of using RMT, however, an understanding of primitive reflexes and the processes involved in their integration is important when assessing the value of this research. A brief explanation of the primitive reflexes, their retention and RMT follows.

1.3 Reflexes Defined: Background Information

This brief description of primitive reflexes and the possibility their typical process can be interrupted is provided to enhance understanding relating to the basis of methodological decisions made, as described in Chapter 3. This research does not ask if there is a primitive reflex integration issue, thus the following information is useful for the reading of the literature review, where studies focused on primitive reflex integration are discussed.

1.3.1 Primitive Reflexes.

Primitive reflexes (also known as infant reflexes or primary reflexes) develop in the womb. They are considered to be part of a child’s neurophysiological development. Neurophysiology relates to the physiology of the central nervous system, which includes the brain (Blomberg, 2015). Primitive reflexes are activated during the birthing process and are useful early in the child’s life. They are considered to be fundamental developmental processes and their involuntary reactions originate in the brainstem (Capute et al., 1984; Desorbay, 2013; El-Dib, Massaro, Glass, & Aly, 2012; Goddard, 1996; Sassé, 2009; Zafeiriou, 2004). As examples, a frightened infant displays a Moro/startle reflex, and the immature bladder is emptied by the Spinal Galant reflex. Through the typical maturation process, the child’s reflexes integrate, and as a result, intellectual processes and movement are controlled by cognition or postural reflexes instead of primitive reflexes (Goddard-Blythe, 2008).

1.3.2 Retained Primitive Reflexes

When the primitive reflex/cognition integration process is interrupted, the result is described as retained primitive reflexes (Goddard, 1996). In typically-developing children, the primitive reflexes become integrated or are transformed within the first 12 months of life (McPhillips &

Sheehy, 2004). Maternal, environmental and birthing process stress have been identified as reflex integration interrupters (Blomberg & Dempsey, 2011; Goddard-Blythe, 2008; Holley, 2010; Hsieh et al., 2011; Thomson, 2007). Learning and behavioural issues have been associated with retained primitive reflexes (Konicarova & Bob, 2012; McPhillips & Jordan-Black, 2007b). Balance problems later in a child's life can indicate retention of the Moro reflex and bedwetting in children over the age of 5 years may be attributed to a retained Spinal Galant reflex (Berne, 2006). It is possible that some of the children who do not respond well to conventional school-based intervention may have retained primitive reflexes (McPhillips & Jordan-Black, 2007a). Research in this area is limited and needs extending. The individual nature of the retained reflex issue has not been addressed in research completed to-date, and while there appear to be clusters of reflexes and commonalities, each child's reflex story is an individual one.

1.3.3 Testing Primitive Reflexes

The presence of primitive reflexes is tested as part of newborn screening tests, but they are not routinely tested as the child matures. The tests commonly used by researchers or occupational therapists involve asking a child, older than five years, to perform a simple physical task while the practitioner observes any associated involuntary movements. An example of one of these tests is asking the child to stretch their arms out at shoulder height and then turn their head to one side. The tester observes the out-stretched arms and the whole body, noting any movement (Goddard, 1996). A child with a retained reflex will find it challenging to keep the arms still with the position maintained while turning the head. The specific tests used in this research are detailed in Chapter 3 as part of the Methodology.

1.3.4 Rhythmic Movement Training (RMT) as an Intervention

The Rhythmic Movement Training (RMT) programme is a series of movements designed by Blomberg and Dempsey using the work of Linde (Blomberg & Dempsey, 2011). The movements are based on the spontaneous movements of typically-developing infants following their birth (Blomberg & Dempsey, 2011; Thelen, 1981). The rhythmic aspect of RMT differentiates this programme from other movement-based programmes where exercises are completed without incorporating rhythm. Physical tests are used when assessing the presence or absence of a child's reflexes (Goddard, 1996). Observable differences in movements can be seen. Children with

observable retained reflexes are then given individualised RMT movements to complete daily. The movements take approximately five to ten minutes to complete each day (Blomberg & Dempsey, 2011). RMT appears to be “easy for families to use within their daily routine and it was a cost effective, low-impact intervention” (Grigg, Fox-Turnbull, & Culpan, 2018, p. 11). Further details pertaining to the movements used in this research are provided in Chapter 3 (Appendices P and Q).

Primitive reflex integration programmes have been described by Brown (2010) as a ‘bottom-up’ intervention, rather than a ‘top-down’ or skill deficit-based interventions as supported by Mather and Morris (2008). RMT aligns with the ‘bottom-up’ approach where the underlying cause of challenges is assessed through the investigation of a child’s primitive reflex profile. Researchers of reflex integration programmes believe that it is essential to address the underlying cause of a skill deficit through movement interventions (Goddard-Blythe, 2005; Goddard, 1996; McPhillips, Hepper, & Mulhern, 2000; McPhillips & Sheehy, 2004) which are detailed in Section 2.3.

1.4 Theoretical perspective: An Intellectual Autobiography

As a qualitative researcher, positioning myself and my experience provides context and orientation of the research known as ontological assumptions (Creswell, 2013; Creswell & Plano Clark, 2011). Crotty (1998) believes that the term ‘theoretical perspective’ more accurately labels what are often termed ontological assumptions because ontology in its purest form describes the nature of reality (or ‘what is’). A theoretical perspective describes the researcher’s perspective or view of the ‘world’ that is being researched, in other words, in this research how I have arrived at the assumptions I have made around children’s neurophysiological organisation, in particular, primitive reflexes and the impact they have on children’s development. Much of this research is based in the area of physiology and neurology, however the intervention used, RMT, is a constructed set of movements and as such, the use of them becomes part of discovering the nature of reality. I am pragmatic and am interested in what is useful, what ‘works’ and what is practical. The theories surrounding pragmatism are discussed in the second

part of Chapter 2. Having positioned the theoretical perspective, epistemological assumptions or how we know what we know, what is the most effective method for obtaining that knowledge legitimately and comprehensively (Crotty, 1998). This aspect of the theoretical framework are covered in Part 2 of the Literature review. This section is written in the first person to convey the personal nature of the material presented. I am a registered teacher and my interest in children's learning processes, especially from a neurophysiological perspective was established very early in my teacher training. As a student at Christchurch Teachers' College during the late 1970's, a sensory-motor integration course with Pru Kernahan instigated my interest with the link between physical activity and learning. Kernahan had returned from an American conference with information from movement specialists Capon (1975) and Doman, Doman and Hagy (1988). Glen Doman was focused on movement-based interventions in his work with brain-injured children at the Institutes for the Achievement of Human Potential in Philadelphia. The positive results from this intense movement programme sparked my interest and thus began a fascination with children's neurology and physiology of the brain/body for the last 40 years.

My interest in movement programmes grew and expanded once I began teaching. Through a range of teaching positions with adult students, as well as primary and pre-school children, the likelihood that there were links between moving and learning became reinforced in my mind. My fascination with brain development, movement and music intensified with the purchase of a GymbaROO franchise in 1995. In 1996 I was introduced to the concept of primitive reflexes and the ramifications of an interrupted reflex process when I attended a GymbaROO conference in Melbourne, Australia. Jane Williams (Programme Director for Toddler Kindy GymbaROO) described a range of immaturities that were noticed in children with retained primitive reflexes. For me, this information offered insight into issues I had encountered with adults and children through my educational work: for example, behavioural immaturity, classroom struggles, hypersensitivities and bed-wetting. During this time, I had added Kinesiology skills (Registered Natural Therapies Practitioner) to my registered teacher skills (music and movement specialist) and was working with approximately 130 children each week. I often reflected on struggling children with many protective factors. It is well established (Cicchetti, Toth, & Maughan, 2000) that protective factors such as: the family being in a middle to high-income bracket, the child having child-focused parents and a stable home life, the family having well-functioning support

systems and the child having high functioning siblings, point to success for children in both academic and behavioural outcomes. The retained reflex work completed by Goddard (1996) offered insight into some of these issues. Through her testing, Goddard found a link between children with retained reflexes and behavioural and learning challenges. The intervention approach she developed was a movement-based programme.

This new information about primitive reflexes improved my insights into the children I was in contact with. When clients first visit my kinesiology practice I gather a history of each adult or child. One question relates to stress associated pre- and post-birth. Although the reasons for engaging a Kinesiologist varied, there were common themes from both children and adults relating to the time associated with their birth. Stories recounting birth process intervention or trauma, or maternal stress before or after birth was common. The examples included: moving to a new house, a physical accident, loss of a baby or a death in the family. I noticed a link; the people seeking the skills of a Kinesiologist to address aspects that were not working in their lives often described stress associated close to or during their birth. I used this information as I continued to develop reflex integration through Kinesiology.

As my understanding of the retained reflex issues increased there began a realisation that there were similarities in my own life path. My own delivery was described as a something akin to a ‘motorbike accident’. My mother was under a general anaesthetic and I was not in great shape, very battered, with a paralysed arm. Fortunately, my mother is a fighter and the suggestion that the arm should be amputated sent her into an ‘I need to fix this’ mode. She did very well – I have two arms, and one of them is just a bit ‘special’. I have often wondered, while focused on completing my PhD, if my delivery contributed to the fact that I really like the RMT movements, they make me feel good, and I notice changes in myself when I use them, particularly when I first started. This is my ‘constructed reality’ of what it means to use the RMT movements. My own delivery may well have contributed to my passion to help others in a similar situation, and my PhD has given me ‘permission’ to explore the whole phenomenon. My research seems to have a focus on circles, in particular, hermeneutic circles, that will be described in detail in Chapter 3. In writing this section it has become clear that what I thought was the ‘whole’ that I

was exploring through the ‘parts’ has, in fact, brought me back to understanding not only a bigger ‘whole’ that is RMT, but also the ‘whole’ that is me.

The final personal aspect of this research was the insights gained through my own child. Harry was delivered by forceps in 2000, and his developmental path was of great interest to me. I recognised some markers of retained primitive reflexes, for example, he was slow to crawl, he made unusual arm movements and he was hypersensitive in many situations. My husband and I provided a sensory-motor rich environment and he participated in a range of activities. While the progression of many developmental aspects was typical of a child his age, we noticed some gaps; he struggled socially at school, found it hard to focus and had multiple sensitivities to food and chemicals. I sold my GymbaROO franchise in 2003 and this allowed an increased focus on kinesiology, music and Harry. At this time I also encountered Dalziell’s work with Dobie’s Bilateral Integration programme (Dobie, Brown, & Dalziell, 2002) at another GymbaROO conference in Melbourne. I have since used some of these activities with children and adults. Again, I was encouraged by positive results particularly with my own son, but there still seemed to be pieces missing from what I knew and understood.

In 2013 I encountered Blomberg and Dempsey’s book *Movements that Heal* (2011). I was fascinated by the description of the Rhythmic Movement Training (RMT) process, and the case histories. I learned one of the movements at a conference I attended and then spent time using that movement myself. I was very interested in the positive change I noticed in my teaching skills: improved sensitivity towards student needs and an increased ability to confidently embrace a ‘teachable moment’. I often caught myself thinking in a lesson “Gosh that was great, where did I get that from?” The next step was to encourage Harry to use them and quite quickly my husband and I noticed positive changes such as his increased confidence and social skills. We could not be certain that the RMT had made the changes, all we knew was the change happened while he was using the movements. Completing further study in RMT and becoming a practitioner enabled me to use the programme in my Kinesiology practice. The experience I gained using the movements then encouraged me to learn about families experiences with RMT, and I completed a Master of Education Degree. The focus of this master’s research was the perceptions of parents who had already used RMT with their children. Parent perceptions have

always interested me in relation to the use of interventions as they are important partners in the process (Koh, Shin, & Yeo, 2010; Williams, 2005; Worcester, Nesman, Mendez, & Keller, 2008). The families in the study reported positive outcomes in their use of RMT (Grigg, 2016) and their experiences matched my own. The logical progression was to explore RMT in the classroom using an academic research process. I have made ontological assumptions that children's neurological wellbeing and readiness for learning needs to be considered before concerns relating to how children learn effectively or viewpoints on learning theory are of interest. Neurological challenges will have an impact on the child's progression, regardless of a person's view on theories of learning or which environment promotes optimal learning opportunities. While I have used the programme and have completed the training I have no financial or managerial affiliation with any RMT organisation.

In summary, I have positioned myself as a pragmatic researcher interested in the child's neurological wellbeing and physiology. This interest has led me to focus on primitive reflexes and their relationship to the development of learning and behaviour. Chapter 2: Literature Review, expands the ontological assumptions described in this chapter as well as focusing on epistemology: what is known about brain development in relation to reflex information, primitive reflexes and classroom-based movement programmes. The second section reviews literature associated with the theoretical framework and the educational theories used to underpin this research.

1.5 Overview of the Thesis Chapters

This section gives an overview of the chapters and the general focus contained within each chapter.

Chapter 2. Part 1: A review of the current literature establishes the extent and focus of the research into primitive reflexes. Current brain research is reviewed to gain an understanding of reflex retention issues in relation to neurological health and research focusing on school-based movement programmes is reviewed to position the approach of this current research. The associated problems when the primitive reflex process is interrupted are reported on in relation to student achievement and behavioural outcomes. This leads to a review of current interventions

that purport to remediate issues associated with retained reflexes. Some programmes have peer-reviewed research to support efficacy while others appear to be lacking this scholarly tradition.

Part 2: Literature relating to the theoretical framework follows, namely the pragmatic paradigm, as it relates to this research. When the theoretical positioning is combined with reflex information this chapter provides the epistemological positioning of the research. The research uses a pragmatic paradigm to uncover issues surrounding the use of a primitive reflex integration programme in the classroom. The theories of Thelen and Hughlings-Jackson focus on aspects of children's neurological development while the theories of Bronfenbrenner and Vygotsky are reviewed as they relate to the placement of RMT in the sociocultural environment of the current classroom environment.

Chapter 3. A description of mixed methods, as part of the methodology used in this research is discussed in this chapter. The justification for choosing a convergent design is explained, as is the reason for choosing to include quantitative data alongside hermeneutic phenomenological qualitative data. Primitive reflex integration is a complex process for a child, and the development of skills is not an evenly timed linear process (Ayres, 1995; Sassé, 2009). Qualitative data was included with the intention of enabling the richness of the process and the complexity of primitive reflex integration to be gathered, through the experiences of the parents and teachers.

Chapter 4. The following two chapters are structured around the three main qualitative themes that emerged from the analysis of data: RMT in the classroom, possible influences in student achievement and student behaviour. In Chapter 4, the 'classroom' is in focus. There is an explanation of the structure of the two findings/results/discussion chapters and the rationale for the decisions made regarding the structure of reporting. The findings, results and discussion are then presented relating to demographics of the participant group and their levels of retained reflexes. This section also includes results relating to the number of days RMT was used, the frequency the movements were completed each week and the integration of reflexes.

Secondly, the perceptions of teachers who used RMT in the classroom are presented. How were the movements managed in the classroom? How did the children feel about the movements, how

did they enhance curriculum goals and how did they fit within the physical classroom space? The parent voice is also heard in relation to their child's response to using the movements at school.

Chapter 5. Student achievement and behavioural outcomes are the focus of Chapter 5. Qualitative findings are followed by quantitative results. Reading, writing, mathematics and neurological development through the Draw-A-Person test are presented, each with a discussion. The findings, results and discussion from a social and emotional questionnaire are then presented with comments from teachers and parents.

Chapter 6. A summary of the findings and results are presented, and the limitations of this research are provided in Chapter 6. Possible next steps are identified in relation to further retained primitive reflex research. Establishing understanding of how retained primitive reflexes interact with student achievement and behavioural outcomes would be of interest. This may support development of cost-effective interventions designed to enhance the learning experience. Finally, conclusions and recommendations relating to the findings and results are presented.

1.6 Summary of Chapter 1

This chapter has identified retained primitive reflexes as the topic of research. The research focuses on a specific reflex integration intervention (RMT) within the classroom. The brief description of retained primitive reflexes, the tests used to assess these, and the intervention are intended to aid understanding of the following chapters. There have been suggestions made that a child's neurological readiness for learning has far-reaching implications on both behaviour and achievement. The personal positioning of the researcher, informed by the literature, set the scene for the research decisions and discussions that follow. Chapter 2 reviews the current literature pertaining to primitive reflexes, their retention, programmes used and the theoretical positioning of the research as it will be used to address these issues.

Chapter 2 Literature Review

2.1 Part 1: The Development of Primitive Reflex

Knowledge over Time

Awareness of retained primitive reflexes is not new (Konikarova & Bob, 2013b) with early discussions documented by Hughlings-Jackson in the 1850's. However, over time, the knowledge and scope relating to the effect retained primitive reflexes can have on children has developed down two pathways: psychopathology and educational outcomes. This chapter focuses on what is known about reflexes in relation to development; an assumption is made that primitive reflexes are part of physical development rather than being socially constructed. However, to progress children's development it is assumed that movement programmes provide an effective opportunity for change through reflex integration. The epistemological positioning of the research is found in Part 2 of this chapter. Theories relating to child development, behaviour, physical movement and retained primitive reflexes are reviewed in this first section of the chapter with two main areas addressed:

- 1:
 - Current brain development research, the underlying theories it is based on and its relationship with movement programmes, primitive reflex retention and integration.
 - School-based exercise programme studies, methodology and findings: giving a rationale for the methodology chosen for the research.

- 2:
- Retained primitive reflex information as it has developed, and the influence retained primitive reflexes have on academic and behavioural outcomes: providing an explanation for the relevance of retained primitive reflexes in education and the need for associated research.
 - Primitive reflexes integration programmes: current movement programmes that have attracted peer-reviewed studies.

2.1.1 Review Methods

The following literature review was based on multiple searches of databases and library material over 36 months. The three main methods used to identify relevant research articles are detailed below. The University of Canterbury electronic databases were the main sources of information. ERIC (Educational Resource Information Centre), PsycINFO (Psychological Literature) and CINAHL (Cumulative Index to Nursing and Allied Health Literature) provided many articles, with Google Scholar sometimes used as a starting point. The range of material increased when multiple subject areas were interrogated, namely Health Sciences, Education and Psychology. An Elton B. Stephens Co (EBSCO) information alert was also put in place. Keywords such as *primitive reflexes*, *primary reflexes*, *infant reflexes*, *reflex integration*, *reflex development*, *movement programmes*, *Asymmetric Tonic Neck Reflex (ATNR)*, *Spinal Galant*, *Tonic Neck Labyrinthine reflex (TLR)* and *Moro reflex* produced results. For most general searches the date parameter was set to post-2000, although this parameter was removed when gathering historical information about primitive reflexes. To ensure the credibility of the research, all articles were required to be peer-reviewed. References on collected articles provided further relevant research literature and bibliographies of books read during the research were another source of relevant scholarly texts.

Research into retained primitive reflexes and the associated educational and behavioural outcomes was of primary focus for this literature review (Brown, 2010; Callcott, 2012; Gieysztor, Choińska, & Paprocka-Borowicz, 2018; Goddard-Blythe, 2012; McPhillips & Jordan-Black, 2007a; Reynolds, Nicolson, & Hambly, 2003). The participants in the studies considered relevant were all primary school-aged children, and in many cases standardised school-based testing was used to identify learning challenges. The search failed to uncover any research on

adolescents with retained primitive reflexes and this area may be worth exploring in future. It could be possible that some immature decisions made by teenagers have a retained primitive reflex element.

Several research articles with a focus on primitive reflexes at varying stages in human development were found. These included the elderly (Hobo et al., 2014), adults (Bruijn et al., 2013; Damasceno et al., 2005; Parfrey, Gibbons, Drinkwater, & Behm, 2014), infants and environmental factors research (Hsieh et al., 2011). While the area of retained reflexes is clearly multi-faceted, a decision was made to limit the scope of this literature review to educational achievement and behavioural outcomes for primary school-aged children. However, before primitive reflex research can be discussed meaningfully, a brief discussion relating to the current theories around early brain development will provide a framework for the retained reflex information.

2.2 Current Understanding of Brain Development and Movement

A review of current brain development knowledge is useful when exploring the issues relating to primitive reflexes. For centuries, scientists, educationalists, psychologists and medics have been intrigued by how the brain develops and functions. Prior to neuroimaging, autopsy and observation were used by researchers to develop theories as to what they believed was happening in the developing brain. One such researcher was MacLean (1982), an American scientist who studied brain development in reptiles, mammals and humans (MacLean, 1982). He described the brain metaphorically in evolutionary terms, with three layers surrounding the brain stem (MacLean, 1982). He termed the spinal cord, brain stem and cerebellum as the neural chassis, and likened them to the brains of creatures such as fish. He believed that primitive reflexes originated here. Next to the brain stem was the mid-brain or basal ganglia (he termed this the reptilian brain because of his belief that it originated from reptiles). He theorised that basal ganglia were responsible for inhibiting the primitive reflexes, and that this inhibition was achieved through movement. The next layer of the brain according to MacLean was the limbic system or mammalian brain. It was this system that housed emotions, memory and learning.

Finally, in this ‘onion’ style brain model, was the neocortex or human brain, and he concluded that it was this layer that controlled our human abilities of judgement, control of impulses, attention and initiative. Sensory processing happens in this part of the brain, especially in the occipital, parietal and temporal lobes. This “triune brain” theory was also popularized by Carl Sagan in his book *The Dragons of Eden* (1977). He described the evolutionary process of human development using fish, reptiles and mammals to describe the different parts of the brain. Blomberg (2015) also uses the description of the Triune Brain in his explanation of how this system of movements works. In his book *The Rhythmic Movement Method* (2015) he aligns his theory with explanations based on MacLean’s work, as to how primitive reflexes impact each ‘layer’ of the brain. However, he does not go so far as to use the images of the three layers as MacLean did and he talks more about systems within the brain: brain stem, limbic system and neocortex. During an interview with Blomberg (personal communication, January 5, 2018), he stated that he viewed the ‘triune brain’ theory as a metaphor for the stages that a brain progresses through as it matures rather than physical layers within the brain. The stages of brain development have been observed by scientists, educationalists and parents over time and Blomberg sees the MacLean theory as a way of explaining the stages.

Another model of brain maturation processes, the Pyramid of Learning, was formulated by occupational therapists Shellenberger and Williams (1996). This is shown in Figure 2.1.

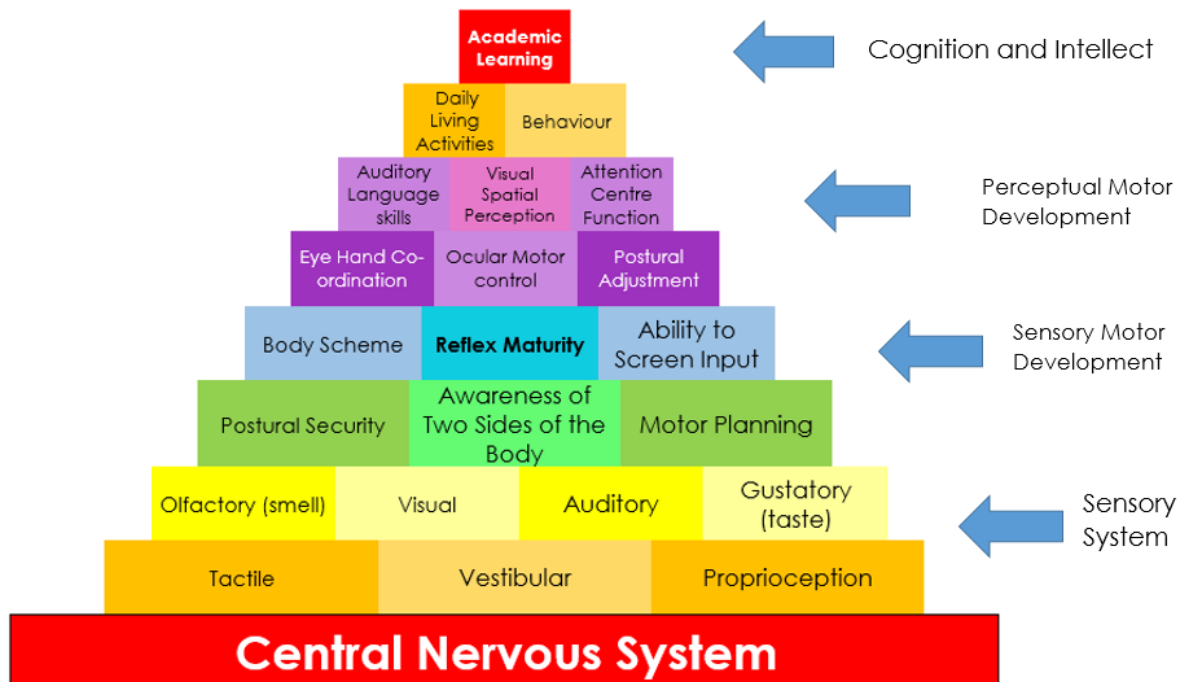


Figure 2.1. Pyramid of learning.

Again, they see the brain developing in steps with different focuses at different stages. According to Shellenberger and Williams, a young baby's brain operates from the central nervous system and then progresses to the sensory system and on up the pyramid as they develop. They did not associate ages with each stage, acknowledging that each child develops at a different rate, but that all children needed to develop these blocks for learning. If their approach was taken literally it would assume that no academic learning takes place until all the other blocks in the pyramid are in place. These models have been used as a way of explaining the stages a child's brain progresses through as it matures.

Advances in neuroscience have added to brain development understanding. Access to functional magnetic resonance imaging (fMRI) and electroencephalograms (EEG) have contributed to greater understanding of how different areas of the brain interact (Barrett, 2017). As a critic of MacLean's model, Barrett states that the brain is not a "layer cake" with ancient circuits of the reptilian brain, inside a fully baked 'limbic system' cake, with the icing on the top representing the outer cortex. Research by Finlay, Hinz and Darlington (2011) points to all vertebrates having divisions in their brains, and that in mammals, length of gestation and time of brain growth

relates to the size of the brain. In humans, there is a small but significant link between the size of the brain and its fitness, namely intelligence (B. L. Finlay et al., 2011). Barrett contrasts the two standpoints, nature versus nurture, in brain development which she says opponents often view in “caricature”; a classical view which has Darwinism and evolution at the core, and a construction view which focuses on the environment and, more recently, culture. She explains:

Modern neuroscience, however, has burned down both caricatures. We are not blank slates, and our children not ‘Silly Putty’ to be shaped this way and that, but neither is biology destiny. When we peer into the workings of a functioning brain, we don’t see mental modules. We see core systems that interact continuously in complex ways to produce many sorts of minds depending on culture. The human brain is itself a cultural artefact because it is wired by experience”. (Barrett, 2017, p. 170)

This view is also supported by Cusack, Ball, Smyser and Dehaene-Lambert (2016), who discuss the leaps in what is understood about brain development through the tools of neuroscience.

When it comes to what is believed about the emergence of abilities, there are ever-changing time frames. For example, ‘Theory of Mind’ that was thought to develop at approximately four years, is now believed to start developing at six months (Cusack et al., 2016, p. 77). The process of developing the brain circuitry begins *in-utero* (Ball et al., 2014), with regional specialisation in the brain detectable at 27 weeks gestation and the infant brain showing more complex patterns of connectivity at birth, and being much closer to the adult patterns than earlier thought (Ball et al., 2014).

Neuroimaging shows researchers the cognitive structures in place for the learning infant to expand their abilities. This new information then poses the question that if an infant has high levels of brain function, why does it take them so long to learn skills? Cusack et al. (2016) suggest that this is tied to the large number of cognitive tasks that are presented to the infant at birth and their need to focus on what is important to their survival. Maturation of the brain circuitry was discussed in relation to pre-term infants with a note made that early disturbances of the neural system appear to have long-term effects. However, the role primitive reflexes play in this process was not mentioned by Cusack and the power of movement was not linked to the development of the infant. Hannaford (2005) used electrodes on the heads of children to assess brain activation during reading, maths and physical activity. She found that similar areas lit up in the brain when children were engaged in these activities and concluded that movement and cognition were linked and that physical activity could enhance learning.

Cusack et al. (2016) collated brain neuroimaging studies from the last ten years and described the processes of the developing brain through emerging research. Prior to neuroimaging, post-mortems were the main source of information used by neuroscientists to study patterns of brain development. However, neuroimaging allows these patterns of development for one child to be followed and then compared with others. This has confirmed some theories and has given insight into new areas. Initially, the growth of the cortex was in focus for the developing infant, with the primary sensory cortex developing early in the gestation process, before 27 weeks, and the frontal, parietal and temporal cortices showing greater rates of change in the third trimester. The formation of regions with apparently specialised functions and architecture has been shown through neuroimaging. The formation of sulci (grooves in the brain surface) and gyri (the bumps on the brain surface) creates a process called gyrification which is considered an indicator of regional specialisation. Gyrification is the process where the brain increases its surface area, through increasing bumps and folds (grey matter). There is a fourfold increase in grey matter during the last 10 weeks gestation (Cusack et al., 2016). At birth, the brain appears more mature than originally thought and the gyrification process slows dramatically after birth (16% increase in brain surface in the first year of life and 6% increase in the second year) (Cusack et al., 2016).

Another process within the developing brain is the formation of white matter. At 10 weeks gestation, the process of developing white matter begins and the associated connecting of the regions of the brain, and the brain connecting with the brain stem. The process of creating a series of connective lines, described as functional connectivity, enables the human infant to develop the potential for higher-order cognitive functions. The brain can be described as a series of fibres that create a network of connections, and mature connections are apparent before birth (Cusack et al., 2016). After birth, the connective tracts continue to mature. To assess this process, resting-state functional magnetic resonance imaging (*rs* - *fMRI*) can be used to capture regional brain activity when stimulation and goal-directed activity are absent. The findings of such research in young infants highlights the development of the primary motor and sensory cortices. Development of the networks differs for each infant and the differences are linked to genetics, anatomy, movement, and external experiences (Cusack et al., 2016).

Functional organisation of the brain has been observed pre-birth with strong similarities to the adult brain's network structure and that of the infant. This is contrary to previously held views of brain development where it was assumed that the structures had to be progressively developed as in Shellenberger and Williams' model (1996). The other surprising result from neuroimaging is the observation of high-level regions of the infant brain involved in cognition soon after birth. Previously it had been assumed that areas such as the frontal cortex were immature and therefore not available to the developing infant (Cusack et al., 2016). However, when Cusack et al. provided stimulation for the infant, the nature of the stimulus appeared to determine which area of the frontal cortex was activated. This information challenges the belief that specialisation of the brain begins in low-level regions and moves to higher levels through a developmental process.

If a baby has access to the full working structures of its brain, then why can't they read at birth? Cusack et al. (2016) discuss the need for microcircuitry refinement, a process involving the formation of the synapse (junctions that allow information to flow from neuron to neuron) and then the pruning of those synapses along with myelination (putting a fatty coating on the neuron) which accelerates the transfer of information. This process increases the speed of function in the infant's brain and then helps the older child maintain that speed as the brain becomes larger and the processes more complex. Although neuroimaging has provided new insights there are still unanswered questions as to how the infant brain, with its seemingly complex structures and functioning, develops into a high-functioning adult brain. It appears that lack of experience and the need to deal with multiple new and complex sets of information makes the infant focus on what is of greatest importance to their survival as they piece their world together (Cusack et al., 2016). Babies move and their drive to move is of great importance to them in their first year of life (Einspieler & Prechtl, 2005; Marquis, Ruiz, Lundy, & Dillard, 1984; Thelen & Smith, 1994). A European study (Butcher et al., 2009) measured the quality of early spontaneous movement of children at 11–16 weeks post-term and then their intelligence as seven to 11-year-olds. They found that the quality of the movements the children made as infants were linked to their level of intelligence as middle-school children.

Movement skills have been shown to be underdeveloped in children on the autistic spectrum (Green et al., 2009; Leisman, Braun-Benjamin, & Melillo, 2014). A British study (Green et al., 2009) assessed the data from a general population group of 56,456 nine to ten-year-old children. Through a range of testing, a subset of 158 children was identified as having possible Autistic Spectrum Disorder (ASD) or Autism. One hundred and one children completed all the elements of the Movement Assessment Battery for Children (M-ABC) required for inclusion in the study. This requirement ensured that each child had a completed total impairment score. None of the children in the study had neurologically-based motor dysfunction. The selection of participants from a general population was seen as a strength of the research as many studies use children from hospital clinics where neurodevelopment may have been the focus rather than motor development. It was noted that to gain access to the clinics children's dysfunction levels were often more complex in their presentation, thus having the possibility of over-representing the problem. Of the 101 children, $n = 80$ (79.2%) were assessed as having significant motor problems, $n = 10$ (9.9%) had minor motor problems and $n = 11$ (10.9%) had no motor problems identified. Intelligence quotient (IQ) testing was completed for 101 children and a strong correlation was noticed between motor dysfunction and an IQ lower than 70 ($n = 35$, 97.1% $p = 0.001$). Nearly all the children within the study who had ASD or Autism and an IQ below 70 had motor problems, while only two-thirds of the children with an IQ over 70 showed motor problems. The researchers concluded that the higher rates of motor dysfunction in children with lower IQs could be linked to a higher level of neurological dysfunction. This research supports the notion that movement ability can be linked with neurological function and as will be shown further on in this review, there is research that shows clear links with Attention Deficit Hyperactivity Disorder (ADHD) and reflex retention. Is it possible that autism may have a primitive reflex retention element as well? Blomberg and Dempsey believe there is a link (2011).

The plasticity of the brain has also been in focus over recent years (Vértes & Bullmore, 2015). This ability to make changes in the brain, especially in infancy, has been the source of promoting the importance of parenting in the early years and early childhood education (Sanders, 2010). Current theories seem to focus on a belief that if there are opportunities to improve the functioning of the brain it is beneficial to start early. This could also apply to reflex integration issues in relation to the plasticity of the brain. Early intervention, in relation to reflex integration

programmes, does not appear to have been the subject of research, but with increasing use of neuroimaging, the possibility of researching the best time to address the issue has improved. Williams (2005; Williams & Holmes, 2004) supports the need for early intervention noting that many challenges faced by children are not identified until the child is at school. She considers this to be too late and a missed opportunity for effective early intervention.

Stress and brain development have been linked by researchers (Perego, Caputi, & Ogliari, 2016; Teicher et al., 2003; Teicher, Samson, Tomoda, Ashy, & Andersen, 2006). Perego et al. completed a review of 34 studies where neurobiological outcomes were assessed in children who were cared for in institutional settings from birth. The research revealed that the children in institutional care and those subsequently adopted showed reduced brain volume and lower levels of cortical activity. The activity in the limbic and frontal areas was altered, and Perego et al. (2016) found some studies reporting abnormality in white matter, particularly connections between the amygdala and frontal regions and limbic and paralimbic areas. Traumatized children, either from institutional care or a traumatic event were found to have an increase in the right amygdala volume and increases in cortisol levels. This appeared to be linked to an increase in psychopathology. The limitations in the research were focused on the narrow range of children in the studies. Most children were from Eastern European institutions and this was seen as a limitation due to extreme levels of poverty in those countries. Teicher et al. (2003) also discuss the link between postnatal stress and developmental processes in the brain with some adaptations at highly sensitive stages having an increased effect. They describe a “stress-responsive pathway” where exposure to stress in the brain can create significant medical problems (heart conditions and type-II diabetes) and psychopathology. There have been indications that reflex retention is also a response to stress (Blomberg & Dempsey, 2011; Goddard-Blythe, 2008; Goddard, 1996).

2.2.1 School-based Exercise Programme Research

Movement programmes are included in New Zealand school curricula through physical education programmes (Te Kete Ipurangi (TKI), 2014). Culpan (2017), who has been involved in the development of the NZ Physical Education Curriculum, sees movement as the key contributor to the development of physical skills, as well as social, cultural and emotional

learning. However, the inclusion of movement-based programmes to address student achievement in schools has attracted criticism over the last ten years (Dehn, 2008; Stephenson, Carter, & Wheldall, 2007). In 2007, Australian research (Stephenson et al.) focused on Perceptual Motor Programmes (PMP) and found no evidence to link participation in a movement programme with improved academic abilities in children. The weekly duration of the programmes was provided by 11 of the 117 school websites searched, with variations between once and three times a week found. It is possible that the regularity of the movement programmes may play a role in the success of the programme. Dehn (2008) is also a critic of the perceptual-motor programmes from the 1970's. His support lies with the cognitive training of the brain through a range of media that include computer training.

In contrast to the movement/learning critics cited above, several studies have reported positive relationships between movement-based programmes and cognitive development (Alesi, Bianco, Luppina, Palma, & Pepi, 2016; Esteban-Cornejo et al., 2014; Haapala, 2013; Hillman, Erickson, & Kramer, 2008; Mullender-Wijnsma et al., 2016; Sibley & Etnier, 2003; van der Niet et al., 2016; Williams, 2015). Williams (2015) completed a longitudinal study on the Australian Toddler Kindy GymbaROO's school-based neurodevelopmental movement programme, Unlocking Potential (UP), with 400 children aged five to eight years. She used the Draw-A-Person (DAP) test to assess neurological age development against chronological age. She also collected academic data to measure progress made. Schools in the study approached GymbaROO with a view to implementing the UP programme in their school. All teachers completed the training after which several teachers decided not to implement the programme in their classroom. The children in these classrooms ($n = 86$) became the control group. Williams noted that the classes were evenly balanced in relation to academic ability, ensuring that high numbers of low or high performers could not influence the results. The intervention group ($n = 314$) completed a 30-minute exercise programme, three to five times a week for 10 to 12 months. The scores of the UP students and non-UP students were also compared with a larger comparable group ($n = 594$) of mean standardized scores of the DAP test. Neurological development within the exercise group showed a 'maturing' of 22 months in the 10 to 12 months. When compared with the control group, where the neurological development was six months during the same timeframe, the results of the exercise intervention were encouraging. Pre-intervention, both groups showed

that their chronological age and neurological age were within a month of each other. Children are expected to increase their chronological age and neurological age at a similar rate. Williams believes that the UP movement programme was responsible for these differences. The results highlighted statistically significant improvements in the curriculum areas of writing, reading, spelling and mathematics ($p = 0.05$). Teacher comments took account of the academic improvements, as well as increases in social and emotional development, particularly in the areas of social skills, behaviour and general happiness of children. Williams has acknowledged her personal involvement in the development of UP, but she encourages independent research of the programme so that the efficacy can be tested and an expansion of knowledge in the area gained.

Studies linking physical movement and executive functioning have been reviewed (Hillman et al., 2008; van der Niet et al., 2016). After evaluating a range of programmes, Hillman et al. (2008) commented on the duration and timing of the activity in relation to the success of the programme. They suggested that increased frequency leads to an increase in cognitive skills. In the Williams' research (2015) the exercises were completed three to five times a week and the success of the programme was in part attributed to this level of frequency.

Several other studies have made connections between physical activity and increased cognitive skills (Alesi et al., 2016; Esteban-Cornejo et al., 2014; Haapala, 2013; Mullender-Wijnsma et al., 2016; Sibley & Etnier, 2003). In South Africa, researchers assessed an exercise intervention using perceptual motor skills as the measures (Erasmus, Janse van Rensburg, Pienaar, & Ellis, 2016). Forty-eight children with low Socio-Economic Status (SES) were divided into two groups, 21 participated in the intervention and 27 were the control group. The Draw-A-Person (DAP) test was used to assess neurological development, alongside perceptual-motor skill testing. Children participated in a perceptual motor programme (PMP) three to five times a week, a similar frequency to the Williams' study. After 10 weeks, school readiness was assessed, with 33% of the intervention group showing improvements in skills development compared with 14.8% for the control group. This mixed-methods research also asked teachers about changes they had noticed in the children's skills and behaviour. The themes that emerged were: longer and better concentration, improved ability to execute tasks and improved motor coordination.

This study did not focus on retained primitive reflexes although the programme does have some ‘neurological-based’ exercises included.

2.2.2 Interventions: Teachers’ Beliefs and Practices

The placement of any intervention in a classroom relies on successful implementation. While this current research is not focused on teacher education or teachers’ beliefs and practices, it is important to acknowledge that through the research process teacher perspectives were sought on the use of the RMT programme and its ‘ease-of-use’ within the classroom. Teacher beliefs and practices also directly affect the learning and behavioural outcomes for students in a classroom (Rideout & Koot, 2009) and this is influenced by teacher education. Reflective practices are encouraged in New Zealand (Ministry of Education, 2007) so that teachers can meet the key competencies of the curriculum. Rideout and Koot found that the effectiveness of reflective teaching practices was determined by the focus of the pre-service teaching. Research assessing teacher beliefs in relation to their Attention-deficit/hyperactivity disorder (ADHD) intervention preferences was conducted with teachers from New Zealand and United States (Curtis, Hamilton, Moore, & Pisecco, 2014). Curtis et al. gathered questionnaire information from 159 teachers in the United States and 261 New Zealand teachers. They found that the teachers in New Zealand preferred strategies that were delivered to the whole class where children with ADHD were identified, whereas the teachers from the United States preferred individual interventions. The ecologically-based classroom in New Zealand, with less focus on labelling disability and greater emphasis on classroom management strategies, was seen to be the explanation for these preferences. This is useful information when matched with RMT because, as will be reviewed in Section 2.3, this is an intervention that could be used individually or as a classroom activity.

Research relating to teacher perceptions of reflex integration programmes was not found, though teachers’ perceptions about physical education (PE) in the curriculum has attracted research. Morgan and Hansen’s (2008) mixed-methods research completed in Australian primary schools found that teachers believed physical activity was of value because of the health benefits, the positive effect on classroom learning and behaviour and the opportunity to improve social skills. However, in relation to the success of their PE programme there were mixed perceptions. They believed they were able to improve basic motor skills, but in areas of self-esteem, increased

physical activity, attitudes to activity, and social skills they were less confident about achieving the PE goals. Attitudes of the teachers towards PE determined the amount of classroom time engaged in physical activity and their perceptions of the success of the programme, however the research did not determine whether successful PE programmes increased the positive attitude to PE, or a positive attitude to PE was the reason for the successful programme.

Similar New Zealand based research asked for teacher perceptions relating to PE (Dyson, Cowan, Gordon, Powell, & Shulruf, 2018). Teachers believed that physical education was of value, there was a focus on fitness and they preferred the children to be active. A lack of confidence to teach PE was noted in the qualitative interviews, although the survey results indicated high levels of confidence (61% felt confident or very confident to teach PE). Dyson et al. believe that one of the factors influencing this lower level of confidence was the time allocated to health and PE in pre-service education.

Teacher education would appear to be influential in the success of movement-based programmes in early childhood settings. American research (Gehris, Gooze, & Whitaker, 2015) found that while teachers believed that movement opportunities for children were important, they were less confident that they were able to provide good quality activities for children that promoted both cognitive and social development. Similar results were found in a New Zealand study of teacher knowledge and ability to implement physical activity in an early childhood setting (McLachlan et al., 2017). A movement programme was provided by movement specialists within the early childhood setting and teachers participated in continuing education sessions. As a result of the increased knowledge there was an increase in teacher awareness of the needed to promote physical activity, but this did not translate into the confidence to continue to provide challenging physical activities. The teachers also believed that a lack of resources reduced their ability to provide the activities demonstrated during the research. While this current research was not focused on teacher education in relation to the implementation of RMT, these studies indicate that it could be an important consideration in future research.

2.3 Retained Primitive Reflexes

This section focuses on the progression of understanding over time of primitive reflexes and their retention. Current literature on motor development, cognitive development and behavioural issues in relation to the retention of primitive reflexes are also reviewed. Finally, programmes designed to aid the integration of primitive reflexes are highlighted, with a view to positioning RMT.

2.3.1 Pre-2000

The phenomena of retained primitive reflexes and their effect on a child's later development has been of interest to psychologists and educationalists (Callcott, 2012; Goddard-Blythe, 2005; Konicarova & Bob, 2012; Livingstone & McPhillips, 2014; McPhillips & Sheehy, 2004; Taylor, Houghton, & Chapman, 2004). John Hughlings-Jackson, a doctor and neurology pioneer, began his work in the 1850's, and his theory is reviewed in section 2.6. Research between 1930 and 1990 appeared to be focused on further understanding Hughling-Jackson's theories and the role primitive reflexes play in human development. Primitive reflexes as an indication of neurological disorganisation was the subject of early research by Furfey, Bonham and Sargent (1930). They tested 17 early reflexes of 62 new-born infants in an attempt to determine mental ability. The conclusion was that the newborn had no mental ability, rather that a maturation process happened after birth. These conclusions were made purely through observation of the infants, lacking the sophistication of the fMRIs and EEGs now used to assess brain functioning. As already discussed above, the infant's brain is more advanced than was thought at the time of Furfey et al.'s research (Cusack et al., 2016).

Further research in the 1980's (Capute, 1982; Capute et al., 1984) focused on the retention of primitive reflexes when diagnosing neurological and developmental progression. Normal functioning of the reflexes was assessed in 381 typically developing infants over a 24 month period. Infants with known stresses such as prematurity and postmaturity were excluded from the research. Nine readily-observable reflexes (ATNR, Symmetrical Tonic Neck Reflex (STNR), Positive Support, TLR (forwards and backwards), Segmental Rolling (head-on-body and body-on-body), Spinal Galant and Moro reflex) thought to have been related to motor function were

observed. From these observations, typical movement patterns were established and a reflex grading system developed suitable for inclusion in neurological examinations. In tests such as the Touwen Infant Neurological Examination (TINE), newborn movement patterns are observed and primitive reflexes assessed. Variations from the norm are noted as possible indicators of developmental delay. These tests can also be the basis for recommending newborn early interventions (Hadders-Algra, Heineman, Bos, & Middelburg, 2010). Primitive reflexes such as the ATNR, Moro, Palmer grasp (baby will hold a finger placed in the palm) and Spinal Galant are still tested in newborns (Nursing Editor, 2007) as part of a neurological assessment (Zafeiriou, 2004).

Using retained reflexes as a diagnostic indicator was documented pre-2000. A study by Friedlander, Pothier, Morrison and Herman (1982) of 60 Californian children aged 39–121 months (mean age 6 years 10 months) tested the children for the presence of “soft signs of neurologic impairment and psychopathology” (Friedlander et al., 1982, p. 103). The range of participants tested included $n = 20$ attending mainstream classrooms with no diagnosis of psychopathology or developmental delay, $n = 20$ attending remedial schools with a diagnosis of developmental delay and $n = 20$ attending remedial schools with a diagnosis of emotional disturbance. The Primitive Reflex and Postural Adjustment (PRPA) scale included tests for five primitive reflexes, seven equilibrium reactions and ten righting reactions. The results showed a marked difference between typical children’s scores and children showing developmental delays and psychopathology. The researchers concluded that the PRPA test provided useful information in identifying neurological delays and psychopathology, although the test was not able to distinguish between the two. In 1994, Blasco encouraged the use of retained primitive reflex testing in medical settings to aid motor delay diagnosis. Movement programmes were recommended but the lack of research attesting to the effectiveness of such programmes was highlighted. He concluded that in the absence of an EBP, a movement programme would be the most appropriate course of action (Blasco, 1994).

Hughlings-Jackson’s (as cited in Konicarova & Bob, 2013b) theory linked ‘persistent’ primitive reflexes with a range of neurological and psychiatric diagnoses. Brain dysfunction was associated with the re-emergence of reflexes in disorders such as schizophrenia, Parkinson’s

disease, dementia and bipolar disorder (Konicarova & Bob, 2013b). This aspect of the primitive reflexes is only mentioned to illustrate the far-reaching effects of primitive reflex retention; it is not being considered in this research as it does not fit within the research question. Melillo's (2011) review of primitive reflex literature wanted to explore the view that disorders such as ADHD have their basis in maturation delays of the brain's cortex rather than "deviant development" (Melillo, 2011, p. 279). With ADHD being cited as the most prevalent mental health condition in the USA (10% of children have this diagnosis), Melillo believed that treating ADHD as a maturity issue had a likelihood of improved outcomes for the child. He demonstrated that the literature supported his belief. He found a strong link between delayed motor development and ADHD, noting that motor skills were often used to predict or diagnose neurobehavioural disorders. Melillo also found literature linking primitive reflexes with cognitive and motor delays in young children. The research articles in his review ranged from the early 1980's through to 2010. He commented that movement programmes were the intervention used by most therapists although he could find no evidence as to how and why they worked. He speculated that the movements increased the sensory feedback to the brain via the nervous system. The movements encouraged reflex integration and the result was increased cortical maturity (2011).

In the 1970's, occupational therapist Rider (1972a, 1972b) collated research relating to reflex integration and its usefulness in early diagnosis in an occupational therapy setting. Studies from the 1960's described the presence of primitive reflexes in children who were considered to be developing typically (Rider, 1972b). Also of interest to Rider was the relationship between learning delays and the presence of primitive reflexes (Rider, 1972a). In a research project, she tested the reflexes of 38 typically developing seven and eight year-olds, as well as using a standardised test: the Wide Range Achievement Test (WRAT) to assess spelling, reading, writing and mathematics. The second group of six to 13 year-olds were participating in a perceptual motor programme and had been identified as having learning delays. Similar tests were completed on the second group. She found that the children in the second group had noticeably higher levels of primitive reflex retention than the typically developing group. There was also a higher level of primitive reflex retention in the boys ($\chi^2 = 5.074, p = <.05$). In the curriculum areas, spelling ($r = .68, p = <.01$) showed significant correlation with retained reflexes

for both groups. Reading ($r = .29, p = <.10$) and mathematics ($r = .23, p = ns$) were considered to be in the expected direction but did not correlate significantly. These findings have been corroborated by McPhillip, Hepper and Mulhern's research (2000) and McPhillips and Jordan-Black's research (2007b) and these are discussed in more detail later in this thesis.

Movement away from medical settings for children with significant psychopathology and developmental delays in relation to retained primitive reflexes started gaining momentum in the 1980's. Blythe, an early pioneer of reflex integration, was initially interested in brain dysfunction (severe depression, anxiety and phobic states) in adults (Blythe, 1979). However, he expanded his interest to include neurological disorganisation in children, which he believed was something that could be remedied. He began work with Goddard-Blythe and they developed an interest in learning and the link to retained primitive reflexes. Goddard's (1996) book, *A Teacher's Window into the Child's Mind*, is considered an early description of neurodevelopment and its relationship to learning difficulties. She described the reflexes in detail and linked the associated indications with motor development and cognitive development. Tests were provided for teachers to use, some of which have been used in this research (Appendix S). Goddard also suggested physical classroom changes to aid learning for children with identified retained primitive reflexes. In 1975, Goddard and Blythe established the UK-based Institute of Neuro-Physiological Psychology (INPP) and offered the INPP programme as a solution for retained primitive reflex issues (Goddard, 1996). In the following section of this review, post-2000, research on the efficacy of the INPP movements is reported.

2.3.2 Post-2000

Key researchers of retained primitive reflexes post-2000 have included Goddard-Blythe, McPhillips, Konicarova, Bob and Jordan-Black. Research based in Irish primary schools (McPhillips & Jordan-Black, 2007a, 2007b; McPhillips & Sheehy, 2004) linked lower academic outcomes and a retained Asymmetric Tonic Neck Reflex (ATNR). Children diagnosed with ADHD (in accordance with the DSM-IV criteria) (American Psychiatric Association, 1994) were found to have retained Moro and Spinal Galant reflexes (Konicarova & Bob, 2012). These studies indicate that children with educational and behavioural difficulties may have retained

primitive reflexes and that their cognitive and physical outcomes may be influenced by addressing the reflex issues.

No studies were found where neuroimaging was used to compare the brain of a child operating with multiple primitive reflexes still in place and the brain of a child with integrated primitive reflexes. Such research would be useful to help understand how the brain, with retained reflexes, functions in a range of situations. Reflexes can be observed in children through a series of tests (Goddard, 1996) which are used by educationalists and medical professionals. As described in Section 2.2 (Cusack et al., 2016), neuroimaging has provided greater understanding of the processes within the brain, but no research linking atypical processing and retention of primitive reflexes through neuroimaging was found in the literature search.

The presence of a hierarchy in relation to the integration of primitive reflexes was the focus for some researchers. Futagi, Toribe and Suzuki (2012) promote the view that primitive reflexes have a hierarchy and that the integration of a higher reflex is dependent on the integration of a more primitive reflex. They focused on the Palmer grasp reflex (the vice-like grip of the infant's hand – thought to be left over from a time when hanging on was crucial to survival) and the Moro reflex, due to their usefulness in medical diagnostic situations. While the review in this section focused on retention or integration of primitive reflexes, it is also possible for children to present with one or more primitive reflexes missing. As Futagi et al. (2012) found, children with a weak or absent Palmer grasp during early infancy may also have nerve or spinal cord damage, seen as an indication of Cerebral Palsy. The Palmer grasp is a reflex that develops in early gestation (Futagi et al., 2012). Children with an absence of the Moro reflex are often diagnosed with multiple delays and Futagi et al. (2012) suggest that this reflex is centred in the lower pons or medulla of the brain and thus slightly later in the development hierarchy. This implies that the hierarchy of primitive reflex possibilities starts with an absence of primitive reflexes, moves to present primitive reflexes being integrated and finally present primitive reflexes that are retained. Hughlings-Jackson (Franz & Gillett, 2011) supported the model that reflexes progress in a hierarchy as do Blomberg and Dempsey (2011). Figure 2.2 shows the typical progression of the primitive reflexes (Goddard, 1996) but it is possible for there to be an absence of a reflex or for it to be retained beyond what is expected in typical development. Birth is calculated at 41 weeks,

93 weeks is the 1st birthday, 145 weeks is the 2nd birthday and 180 weeks is 17 weeks before the 3rd birthday.

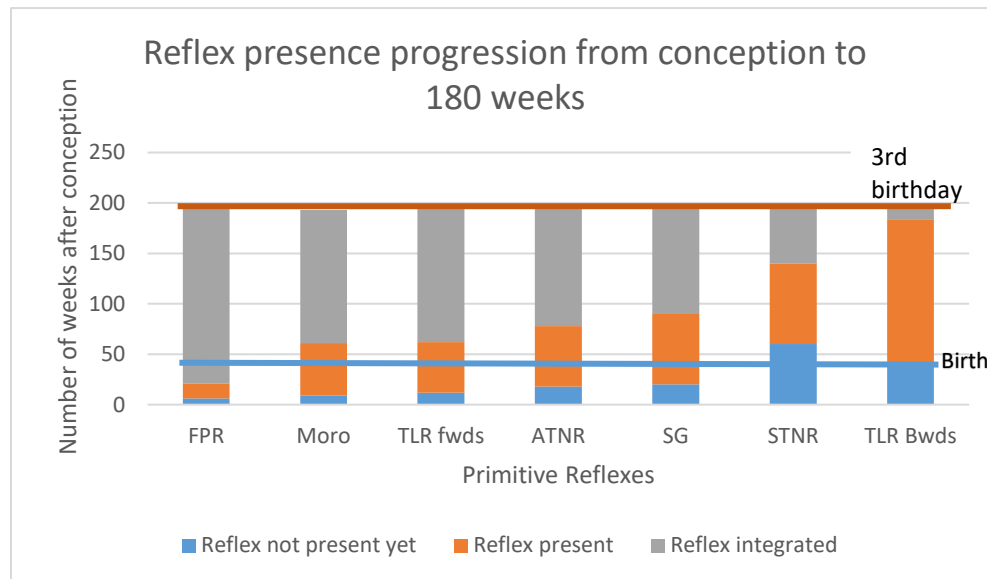


Figure 2.2. Reflex presence progression from conception to 180 weeks. The blue line indicates time of birth and the orange line indicates the third birthday (Collated from information in *Movements that Heal*, Blomberg & Dempsey, 2011).

2.3.3 Motor Development, Cognitive Development and Retained Reflexes

Studies linking cognitive and motor development in children continue to be produced post-2000 (Callcott, 2012; Desorbay, 2013; Goddard-Blythe, 2005; Holley, 2010; McPhillips, 2003; Sassé, 2009; Sibley & Etnier, 2003; Taylor et al., 2004; Tomporowski, Davis, Miller, & Naglieri, 2008). The fundamental interrelatedness of cognition and motor development is supported by Diamond (2000, 2007). Diamond was interested in the links between genetic-based human development and physical, social and cultural environments. The interaction between genes and the environment led her to recommend a wide-ranging approach to intervention covering multiple aspects of development but maintaining a strong focus on movement-based activities.

Motor development problems, reading delays and the persistence of primary reflexes was the focus of research completed by McPhillips and Sheehy (2004). This Irish study initially assessed the reading levels of 409 nine and 10-year old children. A group representing 10% of the top, middle and bottom readers ($n = 41$ in each group) from the total sample population were assessed

further for motor development delays and the persistence of the ATNR. Additional variables, sex of the child, verbal IQ, free meal entitlement (a measure of SES) and month of birth were gathered. The researchers reported that verbal IQ and SES were strong predictors of the child's reading ability. The ATNR persistence was high in children with poor reading skills, low verbal IQ and low SES. When motor skill and reading delays were matched they proved to be a poorer predictor than the presence of the ATNR. Boys showed a slightly higher, but not statistically significant level of ATNR retention. The research showed that in the bottom reader group ($n = 41$), 30% had a dyslexia diagnosis and concluded that some reading issues were not dyslexia-based. While the levels of ATNR were high in the group with dyslexia, it was stressed that it would be unwise to use the ATNR as a determinant of dyslexia because there were children who had been identified as having dyslexia that did not have the ATNR present. An acknowledgement was made that the assessment of only one reflex was a limitation of the study. The interrelatedness of the reflex process could mean that important data was not gathered (Goddard, 1996) although earlier research showed that the presence of the ATNR had a relationship with lower educational outcomes (McPhillips & Sheehy, 2004; Rider, 1972b).

A more recent study (Livingstone & McPhillips, 2014) links motor development and literacy skills with retained primitive reflexes. The study focused on 25 Irish children aged six – 12 years, identified with partial hearing loss. These children were tested for retained ATNR and the results linked hearing loss, high levels of retained ATNR and deficits in core literacy skills when compared with a control group. The researchers concluded that more research was needed into the influence of a retained ATNR and the emergence of early motor development and literacy skills in children with partial hearing loss. While there has been research linking motor development and literacy skills (Diamond, 2000; Erasmus et al., 2016; Goddard-Blythe, 2012; Piek, Dawson, Smith, & Gasson, 2008), it is possible that the delayed literacy skills could be solely related to the loss of hearing.

A Polish study assessed the level of retained primitive reflexes in young children (Gieysztor et al., 2018). Thirty-five healthy four to six year-olds were tested for the presence of ATNR, STNR and TLR as well as their psychomotor abilities. Goddard's reflex testing was used and Motor Proficiency 4-6 assessment protocol. The statistical analysis showed that 11% of the children had

their reflexes fully integrated, with 89% having at least one primitive reflex still present at this pre-school age. The researchers considered that 65% of the children displayed low levels of reflex integration (scoring one or more primitive reflexes at a level 1-2) and 25% of the children were displaying a level of reflex retention (one or more primitive reflexes at level 3-4) that could impact typical development. The ATNR was most commonly retained (23%) across all the participants. Motor Proficiency testing showed that 62% of the children scored at a level typical of very good development, and 29% scored at a level that indicated developmental delay with 9% scoring in the identified delayed development category. They found that children with high levels of reflex retention scored at the lower end in the motor proficiency tests ($p < 0.05$) (Gieysztor et al., 2018). These researchers state that their study of the reflex retention within a group of pre-school children considered to be developing within the typical range is important, as it highlights the possibility of a generalised issue and points to the need for large scale testing and early intervention. They support the need for training in this area for health professionals and teachers and believe that this information, combined with intervention programmes could reduce social and achievement delays in older children. Focusing on the cause of the developmental issue was concluded by Gieysztor et al. as more important initially than treating the skill deficit.

2.3.4 Behavioural Issues and Their Relationship to Retained Primitive Reflexes

Behavioural issues and the retention of primitive reflexes have been investigated by several researchers (Callcott, 2012; Konicarova & Bob, 2012; Taylor et al., 2004). Attention Deficit Hyperactivity Disorder (ADHD) has been the most common focus for researchers. They all found that children with an ADHD diagnosis are more likely to have some retained primitive reflexes. It is possible that the retained primitive reflexes and their link with immature development cause frustrations for these children (Callcott, 2012), which can lead to their behavioural issues. Konicarova and Bob's (2012) research assessed two primitive reflexes in 40 European children: 20 with an ADHD diagnosis and 20 typically functioning children without the diagnosis. The Moro Reflex and the Spinal Galant were selected due to their association with behaviour indicators. The children with ADHD ($n = 20$) had a mean score of 0.85 (SD 0.81) for the Moro and 0.70 (SD 0.92) for the Spinal Galant. The control group ($n = 20$) had mean scores of 0.05 (SD 0.22) and 0.10 (SD 0.44) respectively ($Z = 3.68$ for Moro and $Z = 2.56$ for the Spinal

Galant and $p = 0.0002$ and $p = 0.0103$ respectively). This showed that children with ADHD had higher levels of retained Moro and Spinal Galant reflexes when compared with a control group. While this study only tested two reflexes and had a small number of participants, Konicarova and Bob suggested that further research in the area would be useful.

Callcot (2012) also linked retained primitive reflexes (ATNR) and behavioural issues. The possibility of retained reflexes impacting skill development and thus creating additional frustrations for the child in relation to school readiness was a focus for Callcot (2012). She found that motor skills, in particular manual dexterity, were delayed in a significant number of participants, suggesting that exploring and interacting with the school environment, e.g. pencil use and cutting with scissors, would be challenging for them. In this study, research participants were Australian indigenous children, and the level of ATNR was assessed. The participants were identified as having multiple risk factors: low parent education achievement and low socio-economic (SES) households. Motor skills were measured, as was their retention of ATNR, with interviews providing qualitative data on the child's school readiness. Of the 40 children in the study, 67.5% showed moderate to high levels of a retained ATNR. ADHD and ADD-type behaviours were identified in children through teacher interviews, and this helped the researchers identify a link between the presence of these behaviours and a retained ATNR. The small sample size and identification of only one reflex were acknowledged by the author. However, the study points to the idea of behavioural issues being linked with retained primitive reflexes.

Taylor, Houghton and Chapman's (2004) Australian study also investigated the link between behaviour and retained reflexes. In their study, 109 boys between seven and 10 years of mixed SES were assessed for the presence of four primitive reflexes: ATNR, STNR, Moro and TLR. Twenty-one children were identified as having no ADHD symptoms, 34 boys had social and learning challenges that included some ADHD symptoms and 54 had an ADHD diagnosis. The testing was completed in a university laboratory setting and adequate conformity was shown through a multivariate analysis of variance (MANOVA). A correlation between retained reflexes and ADHD symptoms was found ($V = .383$, $F(8,208) = 6.166$, $p < .001$ ($F = F$ ratio: between group and within group variance)). Of particular interest was the relationship of a retained STNR to impulsive, emotional and problematic behaviours, yet a retained TLR showed a strong

relationship to impulsive and problematic behaviours, and less for emotional behaviours. Mathematics achievement was found to be lower when the ATNR and TLR were still present. The researchers noted that there was no evidence that a retained Moro reflex related to ADHD or achievement outcomes, but concluded that it was possible that the Moro operated as a ‘gateway’ in the hierarchy of reflex integration, due to the stage of development at which it emerges.

2.3.5 Retained Primitive Reflex Interventions

Movement programmes are the most common form of intervention when retained primitive reflexes are identified (Brown, 2010; Dobie et al., 2002; Goddard, 1996; Jordan-Black, 2005). These programmes have been shown to have a positive outcome on children’s academic achievement and fine motor skills when used in the home and school settings. However, for programmes such as INPP (Goddard, 1996) and the Dore Programme (Dynevor CIC, 2014), the financial and time commitment from families can be significant. Movement programmes used in classroom settings need to be generic for ease of use, which has the potential to dilute positive outcomes (Brown, 2010; McPhillips & Sheehy, 2004). Children do not appear to retain nor integrate their primitive reflexes in a uniform way (Blomberg & Dempsey, 2011) so a programme that considers this could enhance the process. The following section highlights widely-used programmes that have attracted peer-reviewed research. Several programmes in use that have not yet attracted scholarly research are reported, as is the controversy associated with research into one intervention programme.

2.4 Peer-Reviewed Reflex Integration Programmes

While there are many programmes that claim to integrate primitive reflexes, only two reflex integration programmes appear to have peer-reviewed research on which to base their claims. The Primary Movement Programme (McPhillips, 2014) and the Institute for Neuro-Physiological Psychology Programme (INPP) (Goddard, 1996) promote exercises founded on movements made by infants after birth and it is believed that these movements aid the integration of the primitive reflexes. In several studies (Brown, 2010; Callcott, 2012; Goddard-Blythe, 2012; Jordan-Black, 2005; McPhillips & Jordan-Black, 2007b; Taylor et al., 2004), the movement programmes were assessed in relation to academic achievement. The studies were classroom-

based and in most the children were assessed for their level of reflex retention, usually in relation to one or two reflexes. These two programmes and examples of the research they have attracted are reviewed below.

2.4.1 Primary Movement Programme

Several studies have evaluated the efficacy of the Primary Movement Programme. Information about the retained reflexes and the programme McPhillips developed is available via their website (McPhillips, 2014) and already-qualified classroom teachers are invited to complete the training. The organisation has a charity status with course fees for teachers set at UK£1250.00 for an eight-day course that runs one day a week for eight weeks (Byrne, 2002). Jordan-Black's (2005) longitudinal, comparative study assessed the academic levels and ATNR persistence of 683 seven year-old children in Northern Ireland. She found that the presence of the ATNR was significantly associated with achievement levels in mathematics ($F(5,677) = 109.7: p < 0.001$), reading ($F(5,677) = 109.5: p < 0.001$) and spelling ($F(5,677) = 109.5: p < 0.001$) and that boys showed significantly higher levels ($F(1,1073) = 18.0: p < 0.001$) of ATNR retention than girls. On the completion of two years of the Primary Movement intervention, a reduction in the presence of the ATNR was shown along with associated improvements in mathematics and reading. While the study did not assess non-academic developments, it was noted that there was anecdotal evidence of improved self-esteem, improved behaviour and increased engagement in sport.

Primary Movement was the intervention selected by Brown (2010) in her repeated measure design research. She assessed the fine-motor skills of 65 four to five-year old children. The schools she used had low SES ratings and, combined with relevant research (McPhillips & Jordan-Black, 2007b; McPhillips & Sheehy, 2004) showing a correlation between low SES and a retained ATNR, Brown assumed that her participants would also have high levels of retained ATNR. She did not test the children's levels of ATNR and this could be perceived as a weakness in the study design. During the study's five-month timeframe, the intervention group completed Primary Movement exercises and the control group completed another set of exercises. She found a significant improvement in fine-motor skills of the intervention group when compared with the control group. However, two other pieces of research (Jordan-Black, 2005; McPhillips

& Jordan-Black, 2007b) found little or no effect on the skill development of children with integrated primitive reflexes when exercises were completed, meaning that isolating children with retained primitive reflexes, in particular, the ATNR, could have strengthened Brown's results. Goddard Blythe (2005) claims that the level of retained primitive reflexes across all children is approximately 48%, with high levels being shown in 62% of the bottom 10% of readers (McPhillips & Jordan-Black, 2007b). Completing the research in the classroom increased the reliability and meant that the control group could participate in another exercise-based programme. This was to avoid ethical issues relating to the health benefits of exercise. Completing exercises in a classroom also has the potential to increase consistency.

2.4.2 Institute for Neuro-Physiological Psychology (INPP)

The INPP programme uses exercises based on the movements made by children soon after birth. Currently, the INPP training is a one-year post-graduate course and trainees are required to have completed five years in their field (education, medicine or psychology). The course consists of 4 modules, each lasting three to five days (sixteen days in total) with a total cost of NZ\$6447 + GST. Courses are held in Australia as well as other parts of the world. While Goddard-Blythe has written several books, peer-reviewed research relating to the INPP programme is limited to an analysis (Goddard-Blythe, 2005) of research completed by independent researchers from Ireland's North Eastern Education Library Board (NEELB) and a Polish study published in 2017 (Grzywniak, 2017). In Goddard-Blythe's (2005) research several unpublished research projects were completed by independent researchers and the results collated. Three hundred and thirty nine four to five-year olds were assessed for neurological dysfunction using INPP testing as were 205 eight to 10-year-olds. In addition, 235 eight to ten-year-olds completed an INPP-based movement programme for one school year. Collating results was problematic as there were differences in study design, but Goddard-Blythe concluded that students identified as 'under achieving' showed reduced levels of neurological dysfunction after completing INPP movements. The other concern about this research is that Goddard-Blythe is the developer of the programme and directly benefits from favourable results.

Grzywniak (2017) found that the INPP Programme facilitated development for children with a range of learning delays. The 104 children in the study, aged six, 10 and 11 years of age, were

attending a Psychological-Pedagogical Clinic in Kraków where the children's learning challenges had been diagnosed. After working with a therapist for between 12 and 24 months, statistically significant results were obtained, ($n = 50$; $p < 0.001$) for the children using the INPP programme. They had increased psychomotor skills when compared with the control group and improved functioning within the school and at home.

2.5 Reflex Integration Programmes without Peer-Reviewed Research

2.5.1 RMT

Rhythmic Movement Training (RMT) (Blomberg, 2015; Blomberg & Dempsey, 2011) is an individualised reflex integration programme that has been used with both adults and children to address a variety of developmental delays. To date, no published peer-reviewed research has been found relating to the efficacy of the programme. However, recent New Zealand peer-reviewed research (Grigg, 2016; Grigg et al., 2018) investigated the perceptions of parents who had used RMT with their children. Through an interview process, seven sets of parents were asked about using RMT and the perceived effects of the programme. The parents believed their children benefited from using the movements. They said they could easily manage the movements within their family routines and RMT was considered a low-impact, cost effective intervention. The number of participants in this study was small and the effectiveness of the programme was not measured, but this information supports the need to investigate RMT further.

Blomberg and Dempsey (2011) claim that many developmental issues are based on the retention of some primitive reflexes and that encouraging the integration of these reflexes can be of benefit. During a typical RMT session, retained primitive reflexes are identified and movements are prescribed from a range of options that are part of the programme. The reflex tests used are the same as those commonly used by researchers and INPP (Goddard, 1996). One or two movements are chosen by the practitioner, to be completed at home, with the time commitment being between five and ten minutes each day (Blomberg & Dempsey, 2011). However, as the child progresses they are encouraged to choose the two movements they complete each day from the list of movements already known. The RMT process described by Blomberg and Dempsey

includes comments that levels of completion of the movements are high (2011), and these comments are supported by Grigg's (2016) research.

The RMT programme is based on observations made by Lunde (Blomberg, 2015) as she worked with developmentally-delayed children. Although Lunde's work is not published, Blomberg and Dempsey used her observations and conclusions to develop the RMT programme (Blomberg & Dempsey, 2011). Lunde noticed that the typical rhythmical movements made by babies as they played on the floor were missing from children with delays. These observations were supported by other researchers (Berne, 2006; Thelen, 1981; Thelen & Smith, 1994) and the association that these observable movements play an important function in the typical development of an infant's brain has been established (Rider, 1972b; Thelen, 1981). The positive effects of music on brain development has been linked in peer-reviewed current research (Fujioka, Ross, Kakigi, Pantev, & Trainor, 2006; Hannon & Trehub, 2005; Harris, 2008; Lense & Dykens, 2013; Mathur, Duda, & Kamat, 2008; Phillips-Silver, 2009; Phillips-Silver & Trainor, 2007; Zhao & Kuhl, 2016) and it is the rhythmic aspect of RMT that sets it apart from other reflex integration programmes.

Phillips-Silver (2009) discussed the function of rhythm and music from an evolutionary perspective, stating that throughout history there are examples of music being used to bond and create a level of synchronization between individuals through physical movement and emotional bonding. Mothers rock their babies and this is seen to increase the synchronicity between them (Phillips-Silver, 2009). She also describes how neuroimaging can show that a baby's brain will notice when listening to familiar music if a downbeat is missing. She states that it appears that babies are hardwired to detect a musical beat from an early age (possibly *in-utero*). Babies also move rhythmically, as Thelen (1981) demonstrated in her extensive studies of infant movements. RMT combines what appear to be two fundamental elements of development.

Clinical psychologists Perry and Hambrick (2008) developed the Neurosequential Model of Therapeutics (NMT) which is used with maltreated or traumatised children. The NMT process involves neurobiological mapping with the timing of the trauma related to the associated stage of brain development. Interventions are recommended based on the developmental stage in the brain at the time of the trauma. Further interventions are sequentially recommended, working to re-approximate what would have been the child's typical developmental pattern. Perry believes

that it is important to start with the earliest signs of atypical development and progress from that point. An example is a child who may have a poorly organised brainstem, shown through inattention, self-regulation and impulsivity. Perry (2008) advocates the use of repetitive, patterned (possibly musical) activities to aid in brain re-organisation. RMT aligns with this approach and for some children, RMT could be used as a tool in Perry's NMT protocols.

2.5.2 Various Reflex Integration Programmes and their Research

A range of reflex programmes are available for teachers and parents and several of these are briefly reviewed in this section. The purpose of this section is to highlight the range of programmes that are being used that do not appear to have peer-reviewed research to support their claims. It would appear that parents will do all they can to help their child and if they hear about the positive results they will support the programme. This view was highlighted in Grigg's (2016) research when family perspectives about RMT were being investigated. One parent made the following comments:

... you know as soon as someone says psychologists say or scientists say "Oh you know, you shouldn't trust it because there is no scientific evidence" It's like I don't care, if it works...I don't care if there's scientific evidence or not, the evidence is those children who have done the programme, if they had had results. That's all I need. (Virginia) (Grigg, 2016, p. 57)

Sassé (2009), the founder of Toddler Kindy GymbaROO, provides parents with a range of reflex integration exercises in her book *Smart Start* (2009), some of which are based on Goddard's work. To-date there has been no rigorous research supporting Sassé's exercises, other than peer-reviewed research based on Goddard-Blythe's (1996) INPP programme. An essay written by Berne (2006) on primitive reflexes explains several primitive reflexes and describes *An Infant Motor Guidance Programme* with claims that it is designed to integrate primitive reflexes. The essay fails to make reference to any evidence-based research supporting the efficacy of the programme. The Svetlana Masgutova Educational Institute, based in Russia and with international links in Poland and Florida, USA, provides a programme of reflex integration developed by Svetlana Masgutova in 1989, called Masgutova Neurosensorimotor Reflex Integration (MNRI®). While the information on the institute's website (Masgutova, 2017) describes research that the method is based on, a database search revealed only one article written by Masgutova (1990) about methods she used to treat children from a railway accident.

Research articles based on the Masgutova method were not available through the normal peer-reviewed database channels.

A programme that uses a cold laser to integrate primitive reflexes is offered by Quantum Reflex Integration (QRI®). Brandes (2017) cites clinical trials of laser therapy used to treat a range of brain and nervous system conditions and this is the basis of the programme that QRI offers to parents. As with the other programmes mentioned above, no peer-reviewed research relating to this method was found. The lack of evidence-based research and the US\$2,990.00 price of the laser itself would put this programme out of reach of many families.

2.5.3 Dore programme research controversy.

The Dore programme, originally called Dyslexia Dyspraxia Attention Treatment (DDAT) is a movement-based programme. It was developed in 2000 and has been used in the United Kingdom, the USA, Australia and New Zealand. The programme is based on a series of exercises and the organisation claims that the exercises stimulate the cerebellum which in turn increases brain function (Reynolds et al., 2003). However, Reynolds et al.'s (2003) research linking the movement programme and significant reading skill development attracted controversy in the education community. Thirty-five children, a quarter of whom had been diagnosed with dyslexia, dyspraxia or ADHD were divided into two evenly matched groups based on age and Dyslexia Screening Test (DST) scores. Children were assessed using the DST test along with cerebellar/vestibular and eye movement tests and these tests were repeated after six months. The intervention group completed their normal school activities as well as a series of prescribed home-based exercises while the control group maintained their normal school and home activities. The National Foundation for Education Research (NFER) reading test and National Standardised Attainment (STATS) test scores were used for both groups. The authors reported significant improvements (equivalent to having 19 months improvement during the 12 months they were using the exercises) in all areas of reading and made claims that the movement programme created these changes.

Critics of the Reynolds et al. (2003) research claimed that it lacked robust scientific procedures (Bishop, 2007; McPhillips, 2003; Whiteley & Pope, 2003). The control group was highlighted as

a problem because the children did not partake in an additional exercise programme. Reynolds et al. justified their design stating that it was logistically difficult and unethical to ask parents to complete an activity that was known to have no benefit to their children's reading development. McPhillips (2003) and Singleton and Stuart (2003) refuted this claim and stressed the importance of normal scientific procedures to establish credible research results. A second concern related to the fact that the results could be used to convince parents to invest in the programme used in the research. Another critic of Reynold's research design and evaluation methods was Bishop (2007). Reynolds et al.'s statistics reported a 300% improvement in reading skills and Bishop was also concerned that these figures could be used to market the programme to parents. McPhillips (2003) believed that teaching methods, skills and style were likely to have contributed to the improvements. Reynolds et al. (2003) counteracted this criticism by reporting that children who were at their chronological reading age showed six months improvement in the year before the trial, and those same children made 19 months progress during the intervention period. McPhillips (2003) makes the point that with access to skilled teachers, in 12 months children should make 12 months progress and making 25 months progress in two years would be considered typical achievement. Another criticism was that at the beginning of the research the children were matched for dyslexia, dyspraxia and ADHD diagnosis, using the DST and age. However, the results do not report on the challenges identified and tested for. They report on reading skill development (Richards et al., 2003). Richards et al. (2003) believed that this is a design flaw and brings the validity and the efficacy of the research into question. To solve the problem, children with identified behavioural challenges could have been matched for reading ability.

A follow-up paper designed to address the criticisms discussed above was produced by Reynolds and Nicholson (2007). In this paper, it was acknowledged that the reading abilities of the two groups were not matched prior to the data gathering and that the exercise group had a lower reading level than the non-exercise group. A follow-up study was completed with the non-exercise group. This created a delayed treatment design with all children being tested at six, 12 and 24 months on the STATS, NFER and DST tests. Lasting improvements were shown in reading accuracy, verbal working memory and phonological skills, but in nonsense passage reading, timed-based reading and spelling tests, no improvements were found. The follow-up

study also claimed to have ruled out a Hawthorne effect (Reynolds & Nicolson, 2007). No further critical evaluation of the follow-up research was found during the literature review. However, the two issues remain: that the profit-based Dore programme could market the favourable results to parents, and that there were research design issues. ‘Business difficulties’ (Dynevor CIC, 2014) were cited as the reason for the Dore organisation re-branding to a ‘community interest group’ (not-for-profit). Dynevor Ltd purchased the intellectual property rights in 2009 and the programme is currently still being offered to parents.

2.6 Part 2: Theoretical Framework

2.6.1 Epistemological Assumptions: A Pragmatic Paradigm

This section reviews literature relating to the theoretical basis of this research which contributed to formulation of the research design described in Chapter 3. Epistemological assumptions; how research knowledge can be effectively gained, are positioned in relation to the theoretical perspective and the research focus. Creswell (2013) notes that epistemologically, a pragmatic paradigm uses a range of tools to reflect both inductive (subjective) and deductive (objective) evidence. High-quality research has a sound theoretical basis and educational research requires special attention to capture the complexities and characteristics of the issues (Creswell & Plano Clark, 2011; Klassen, Creswell, Plano Clark, Smith, & Meissner, 2012; Klingner & Boardman, 2011). Cohen et al. (2011) discuss the importance of the description of assumptions in relation to theoretical decisions made in the research.

“...ontological assumptions (assumptions about the nature of reality and the nature of things) give rise to epistemological assumptions (ways of researching and enquiring into the nature of reality and the nature of things); these, in turn, give rise to methodological considerations: and these, in turn, give rise to issues of instrumentation and data collection. Indeed added to ontology and epistemology is axiology (the values and beliefs we hold)” (2011, p. 33).

Ontological assumptions or the theoretical perspectives of this research have been described in Chapter 1. The researcher has taken a pragmatic approach to the need for and use of a primitive reflex integration programme. One of the founding philosophers of pragmatism was Dewey (Gutek, 2014) who was a prolific writer on philosophy and education. Gutek describes Dewey’s philosophy, known as experimentalism, as the ability of humans to use their social intelligence

and scientific research methods to explore perceived problems within the natural world. He believed that natural and social interactions within the environment sustained human life. As Gutek states Dewey's theory supposes that "through the application of scientific intelligence and through cooperative social activity, humans can use certain elements in nature to solve problems with other aspects of the natural environment." (2014, p. 85). Primitive reflexes are a neurophysiological state within the body, and an assumption has been made that their retention requires a problem-solving approach. RMT, is viewed as a problem-solving intervention or activity making it worthy of exploration.

Positioning the research highlights the assumptions made, how the research design manages those assumptions and what is considered of most value to meaning and understanding. Real-life problems are the basis of pragmatism - "what" and "how" can this phenomenon be understood? Gutek (2014) states that "a 'truth' is a tentative assertion based on human experience" (p. 76). In his book *How We Think* (1910) (as cited in Gutek, 2014, p. 87) Dewey developed his experientialist epistemology. He argued that there is value in helping solve real-life problems that arise through human experience using a process of reflection. He viewed the reflective thought process as building understanding based on previous understanding and experience: it is ongoing and cumulative. The hermeneutic approach used as part of the research methodology (described in Chapter 3) aligns with Dewey's experimentalist epistemology.

When a paradigm (or worldview) and its associated philosophies, values and assumptions combines positivist and naturalist theories, it becomes what is known as a pragmatic paradigm (Klingner & Boardman, 2011). This method mixes qualitative and quantitative data and was uncommon until the 1980's (Creswell & Plano Clark, 2011). Researchers have been debating its merits ever since. Tashakkori and Teddlie (2003) state that the pragmatic paradigm "rejects the either/or choices associated with the paradigm wars, advocates for the use of mixed methods in research and acknowledges that the values of the researcher play a large role in the interpretation of results" (p.713).

This view resonates with this research; there are real-life problems associated with retained primitive reflexes and the possibility that RMT may positively influence achievement and behavioural outcomes for children is of interest to teachers and parents. The research questions

stated in Chapter 3, clearly ask ‘what’ and ‘how’ questions with the focus on understanding perspectives. However, the purpose of the research is given a higher priority than any particular research design and the researcher gained greater insights into the question through both qualitative and quantitative data (Creswell & Plano Clark, 2011). The next section contributes to the epistemological assumptions of this research by reviewing components of the pragmatic paradigm.

Positivist and naturalist approach. Positivism, developed by the French philosopher Comte brought a scientific approach to the social science of human behaviour, using observation and experimentation to gain knowledge. Cohen et al. (2011) describe the notion that quantitative data analysis is expanded when the researcher combines the roles of data analyst and interpreter of social reality. With the generalised concept of student achievement, a hypothesis could have been developed in relation to RMT. Cohen et al. (2011, p. 1212) define a hypothesis as “a conjectural statement of the relations between two or more variables, or an “educated guess”. This “educated guess” is based on experience, study, observation and reflective thinking and provides information about the relationship between the variables and the implications relating to the testing of those relationships. For this research, a research question, with supplementary questions, rather than a hypothesis, was viewed as a more effective way of providing useful information for teachers and parents about RMT’s influences. Primitive reflex retention involves a complex range of challenges (Blomberg & Dempsey, 2011; Goddard, 1996) and from the researcher’s experience, it was believed that by relying solely on a hypothesis it may not be possible to investigate the complete picture. For example, children’s positive development is not only based on academic achievement. For some children, their reading and writing may remain at a constant level throughout the research process, but they make three good friends during the year, are invited on play-dates and develop basketball skills to an unexpected level. For a child with no established friendships and poor physical skills, these changes would be important to capture. Yet for another child, the aspects of change could be completely different. It is acknowledged that academic outcomes are important to policymakers, teachers and parents and a hypothesis around this topic would be easier to measure. Neurological development and readiness for learning form the basis of this research and the challenges associated with primitive reflexes span student achievement (Blythe & Goddard Blythe, 2012; Goddard-Blythe, 2005,

2008; Goddard, 1996) and behavioural outcomes (Konicarova & Bob, 2012, 2013a, 2013b). Combining this ‘world-view’ with the placement of the intervention in the sociocultural environment (Wertsch, 1985) of a 2017 classroom, social and emotional skills are considered essential parts of development. Interpretation and reflection based on the issues discovered have the potential to provide richer perspectives than those provided solely by hypothesis and quantitative data. As Tashakkori and Teddlie (2003) point out, a strong research question has flexibility and thoroughness when it comes to investigating the complexities of educational development in students, especially when used in the mixed methods environment. They also support having one main research question asking an open ended “what and how” or “what and why” question with supplementary questions that ask quantitative and qualitative questions. In this research the main question asks “What...?” and the supplementary questions ask “How...?” and “What...?” These open ended questions provide opportunities to delve into the meanings and experiences of people who have used RMT and are common in hermeneutic research as described in Section 3.3.

Klingner and Boardman (2011) note that critics of positivism suggest that human behaviour does not always fall into quantifiable categories. There are identifiable patterns in human behaviour, but there are also many exceptions to the pattern and often numeric data will not capture the whole story. Cohen et al. (2011) suggest that positivism critics see science taking a reductionist and mechanistic view of nature, believing that measurement defines the world, concepts are concrete and that they are able to be dehumanized. However, the anti-positivist believes there are some concepts that require description of the lived experience to gain a better understanding. In the case of RMT, it is possible that the perceptions of parents and teachers about the children’s development could add rich data to the information gathered as Koh, Shin and Yeo (2010) found in their study of parents’ perceptions. While in the process of completing a quantitative study of a programme that was being delivered to children with ADHD, they identified that the parent perspective (qualitative data) would add strength to their findings. They were in effect triangulating the data through two research projects, thus increasing the reliability and validity of the study. In this research, triangulation is being used in a similar way to the Koh et al. (2010) study and is described later in this chapter. Parent and teacher perspectives relating to their perceptions of children’s progress, their ability to focus, the children’s social skills and the ease

with which the RMT programme can be used, will be reflected effectively through a qualitative approach. This may address areas of the use of RMT that are more difficult to quantify such as behaviour and social skill changes observed by parents.

Creswell (2013) views qualitative research as having a naturalistic approach, rejecting the belief that universal laws and regularity govern human behaviour. The research avoids the laboratory and is more likely based within the environment of the participant. This is essential when the individual's perspective is being investigated and they are viewed as autonomous rather than plastic replications with similar properties as is preferred in quantitative research (L. Cohen et al., 2011). The naturalistic researcher rejects the need to be detached and objective during the research process, and favours sharing the experience of the participant where possible and working to understand the individual's world from the 'inside' rather than an 'outside' positivist viewpoint. It is acceptable for naturalistic research to be a subjective undertaking that works to understand or explain social reality through the perspectives of the participants. It allows the participant to be viewed as a 'whole' in a world where they construct their own reality and fluidity and change are expected rather than a static, rigid normality. Each participant is considered unique, generalisations are minimal and the individual's interpretation of an experience is valued as it adds understanding to the multi-layered complexity of social reality.

The investigative methodology appears to sit well with the complexities of teacher experiences and parent interpretations of the child's development (Snape & Spencer, 2003). Descriptives, interpretations and perceptions are used, rather than statistical numerical analysis associated with quantitative research (Snape & Spencer, 2003). This applies to the research question used in this research. According to Snape and Spencer (2003), there is "no single, accepted way of doing qualitative research" (2003, p. 11). Observation rather than experimentation is the focus within the environment of the participants. Time involved interpreting the data, discovering rich perspectives and meanings are valued more than in quantitative research (Bogdan & Biklen, 2007), and the ability to be immersed in the data with a goal of interpretation is particularly appropriate for this research. Answering the research questions requires acknowledgement of the complexities associated with child development along with careful consideration of expectations placed on teachers within current classroom environments.

Retained primitive reflexes have a complex range of challenges associated with them, both educational and behavioural (Blomberg & Dempsey, 2011; Goddard, 1996; Konicarova & Bob, 2012, 2013a). The pragmatic paradigm proposes compatibility between the subjectivity of qualitative data and the objectivity of quantitative data, allowing for greater interpretation of both (L. Cohen et al., 2011). Johnson and Onwuegbuzie (2004) support mixed methods research as it bridges the divide between qualitative and quantitative research and as they propose, in many cases is actually closer to what is used in practice. They support the use of the terms ‘exploratory’ (associated with qualitative research) and ‘confirmatory’ (associated with quantitative research) as more accurate descriptors of the research methodology and these are described in the next section. Limited research associated with retained primitive reflexes and reflex integration programmes means that this research is both exploratory and confirmatory. The pragmatic paradigm allows a broader range of research questions and does not confine the researcher to a single methodology. This may provide stronger evidence for conclusions made through the research. However, this approach does have some limitations. Pragmatism may produce fewer immediate and practical results, it may not produce revolutionary or fundamental change in society and the research questions may not have clear ‘answers’ (Johnson & Onwuegbuzie, 2004).

Exploratory Data Analysis. A scientific approach to research assumes that there is a ‘truth’ that can be explained using effective controls (Haig, 2018). A hypothesis is developed based on existing theory, a statistical model established to test the hypothesis and analysis performed on the collected data; confirmatory in its approach it is also referred to as a hypothetico-deductive method. Haig states:

Scientific realism comes in many forms. Most versions of scientific realism display a commitment to at least two doctrines: (1) that there is a real world of which we are part and (2) that both the observable and unobservable features of that world can be known by the proper use of scientific methods. Some versions of scientific realism incorporate additional theses (e.g., the claims that truth is the primary aim of science, and that successive theories more closely approximate the truth), and some will also nominate optional doctrines that may, but need not, be used by scientific realists (e.g., the claim that causal relations are relations of natural necessity) (Haig, 2018, p. 44).

Scientific realism is deductive, it takes a small sample of a population, with a view to establishing correlations or relationships and then make generalisations. The variables are

established when the model is decided upon before the data is gathered. It relies on a wealth of literature from which the researcher develops a choice of “designated features of interest” (Haig, 2018, p. 14) and the statistical model that best explains the set of data to be gathered. Haig acknowledges the importance of confirmatory methods of data analysis within his field of psychology, but he also supports the more inductive approach of Tukey (2018). In the 1960’s, Tukey’s *exploratory data analysis* (EDA) approach, ‘detective’ work alongside commonly used confirmatory statistical analysis, was encouraged. According to Haig, Tukey viewed data analysis as more than purely mathematical statistics, he introduced an artistic element which put an emphasis on researcher judgement and an acceptance of satisfactory solutions to problems. Haig describes a two-step process in EDA where patterns in a data set are suggested and then tested using confirmatory data analytic procedures. Recognising patterns is valued, as is performing multiple analyses as a way to understand what the data is revealing and to make sure that unexpected features are not overlooked. Although this approach was largely ignored before the 2000’s, there appears to be growing acceptance within the fields of Education and Psychology where inductive approaches to research accept the need for exploratory data analysis (Haig, 2018).

Within EDA, Haig highlights four themes that distinguish this approach from inferential statistics: resistance, residuals, re-expression and revelation (Haig, 2018). Resistance accounts for unusual data where outlying results may make the results misleading. Using median values removes the effect of outliers and provides more resistant, robust statistics. Residuals highlight deviations from observed values and predicted values in a regression analysis. Re-expression allows for rescaling or transforming data, e.g. in this research mathematics and reading scores were transformed to a linear scale. Finally, revelation uses display to expose unexpected features (Haig, 2018). In this research, frequency was identified as a factor of using RMT within the classroom.

Research around reflex integration programmes is limited, and to-date no classroom-based RMT research has been found which makes this research exploratory. Limited sources of empirical research and the ability to explore past data gave rise to the exploration of the features within the data set and emergent patterns. This EDA approach fits with the hermeneutic approach used in

this research, as described in Section 3.3. An educated-guess or ‘working hypothesis’ and prior understanding of how RMT may fit within the classroom was the beginning, and through the reflective hermeneutic circles, data were analysed: interpreted and reflected on, then re-analysed as meaning and unexpected features were revealed.

Mixed methods research design needs to accommodate complexities from both qualitative and quantitative methods. Qualitative research has the possibility to generate large volumes of data, which is why sample sizes are commonly limited to ensure that the topic can still be explored through in-depth analysis (Creswell, 2013). In this research, interviews were conducted with seven teachers from four schools, all of whom had used RMT for one school year. Viewed as essential, teacher perspectives relating to the management of the RMT intervention within their curriculum expectations and the physical limitations of their classrooms informed the main research question. Bridges and Searle’s (2011) research highlighted the increase in teacher workloads and the complexity of teacher expectations. They compared the workloads of teachers in New Zealand in 2010 with that of teachers in 1992 and found an increase of 9%, from 50 hours in 1992 to more than 55 hours per week in 2010. The biggest difference was the perceived increase of 84-90% in teacher time allocation to Information Technology Courses (ITC), meeting the special needs of children, assessment and administration, with 51% of teachers believing their workload was unsustainable. Teachers saw prioritising tasks as the only way to manage increased workloads. With Bridges and Searle’s (2011) research in mind, it is reasonable to assume that teachers might be reluctant to use a complicated, and difficult-to-implement intervention, regardless of the potential for improved student achievement and behavioural outcomes. This makes the ‘RMT’s ease of use’ research question highly relevant and while the sample size is small, their perspectives are valuable.

Careful planning is essential in qualitative research. However, it also acknowledges the view that reality is considered “incomprehensible, fluid and shaped and influenced by social interaction” (Arghode, 2012, p. 159). While the research question is developed before the data gathering begins, it may change as the process progresses, thus acknowledging the potential emergence of new ideas from the data. Creswell (2013, p. 45) describes the fluid nature of developing themes, associated patterns and categories taking a “bottom-up” approach. These themes change through

the data gathering process as insights and interpretations emerge. In this research, the research question was modified mid-way to reflect better the progression of the data gathered and the resulting thinking of the researcher. The reflections and observations are a key element in qualitative research and form part of the data (Creswell, 2013). A detailed research diary with observations and field notes was kept throughout. Researchers using hermeneutic phenomenology typically observe others and themselves within the relevant environment, listening carefully to what is being said and the language being used, making observations and encouraging participants to explain themselves to a deeper level (Creswell, 2013). There is an element of ‘insider research’ in this research. As highlighted in Chapter 1, the researcher had already experienced reflex integration programmes and it was this existing knowledge that established her interest in the RMT programme and helped formulate the research questions.

Recent movement-based studies discussed in Chapter 2 resonate with this research. As described in Chapter 2, the South African mixed methods research by Erasmus et al. (2016) gathered a wider range of data than this research. However, they did not gather social (interactions with peers) or emotional (self-regulation, resilience) skill data. The Australian study (Williams, 2015) only gathered Draw-A-Person (DAP) and quantitative academic data. Both studies devoted approximately 30 minutes of classroom time, three times a week to their interventions, with the possibility of placing pressure on an already full school curriculum. In this research, the range of data – academic, social and emotional, sets it apart from previous research. The RMT intervention is a daily time commitment of five minutes, which is shorter than the other two programmes mentioned above, although RMT does not address the full range of motor skills targeted in those studies. Both studies focused on movement but neither focused on retained primitive reflexes. Therefore, this research progresses information in the area of reflex integration movement-based programmes. The theorists, particularly those with movement and reflex integration-based theories described in the following section, provide further justification for the design that has been chosen for this research.

2.6.2 Developmental Theories Underpinning the Research

The developmental theories of Bronfenbrenner, Thelen, Vygotsky and Hughlings-Jackson guided this research. This section reviews literature associated with each theorist’s work and

describes the elements that align with the context of this research. Each theorist has been chosen because either their theories relate directly to neurophysiology: Hughlings-Jackson and Thelen, or their theories relate to the placement of RMT in the classroom: Bronfenbrenner and Vygotsky. Theories relating to learning processes are not reviewed as part of this research as it is believed that neurological challenges have an impact on learning and behaviour (Goddard-Blythe, 2012; Williams, 2015) regardless of the theory described to understand how children learn. Santrock (2014) highlights four key educational theories:

- Behaviourist theories of Pavlov and Skinner (learning through conditioning associated with external stimulation and/or reinforcement of the stimulus response).
- Cognitivist theories of Piaget (learning through mental activity).
- Experiential learning theories of Kolb (learning through problem-solving, trial and improvement)
- Socioemotional learning theories associated with Vygotsky (learning through social interaction and participation in a larger group)

Although each theory differs in their approach, it is argued that neurological health is vital for learning (Blomberg, 2015). This research takes the view that intervention relating to neurological health is an important place to start when focusing on achievement and behavioural outcomes (Blomberg & Dempsey, 2011; Goddard, 1996).

John Hughlings-Jackson (1835 – 1911). Hughlings-Jackson's theory about the 'dissolution' of primitive reflexes has contributed directly to the formulation of the research. His theory was first developed in the 1850's and recent research completed by Konicarova and Bob (2013b) has extended understanding by associating ADD and ADHD in children with his principles of based on evolutionary processes within the central nervous system. Without sophisticated brain imaging techniques, he hypothesised that a child's sensory processes and early movement patterns allow the integration of lower brain functioning which in turn allowed higher functioning of the brain (Franz & Gillett, 2011). The term 'dissolution' was used to describe continuous development where high-level brain processes replaced lower level processes. He believed that if the neural organisation of the brain continued to be controlled by retained primitive reflexes there would be an impact on the individual's developmental progression (Franz & Gillett, 2011; Konicarova & Bob, 2013b). Hughlings-Jackson also linked

epileptic seizures and aphasia with brain functioning and organisational processes; ideas that went against the current thinking of the time. His theories have contributed significantly to current brain research, particularly in the areas of brain organisation and neurological disease (Franz & Gillett, 2011).

Hughling-Jackson's theory supports investigation of reflex integration programmes that attempt to address behavioural issues associated with retained primitive reflexes. His psychopathological analysis of the condition was considered in the research question. While academic progress has in recent research of retained primitive reflexes been the focus (Goddard-Blythe, 2005; McPhillips & Jordan-Black, 2007b), this current research has included emotional and social development, giving them equal importance to academic skills. As described in Section 2.3, children may develop skills not directly associated with academic achievement. Behavioural issues may decline, such as those associated with ADHD, when the child is participating in a primitive reflex integration programme (Koncarova & Bob, 2013a). Building on the theories of Hughlings-Jackson, others (Koncarova & Bob, 2012, 2013b; Melillo, 2011) have also linked the maturity issues of ADHD with retained primitive reflexes. If integrating primitive reflexes could improve children's behaviour, and maybe reduce the need for medication, there could be benefits for teachers and parents.

Esther Thelen (1941 – 2004). Movement as a key component in brain development was central to the theories Thelen developed in the 1970's to 90's (as cited in Spencer et al., 2006; Thelen & Corbetta, 1996; Thelen & Smith, 1994). Initially, her interest was focused on the rhythmical movements babies make when they are given unrestricted opportunities to move (Thelen, 1981). She observed infants and the range of movements they made after birth, noting their duration and intensity, thus creating a developmental progression of behaviours and functional milestones. She also demonstrated the different paths four infants took when learning to reach for a toy. One child appeared to reach the toy more efficiently initially than another child, but as the weeks progressed that child became less skilled as she did not make the adaptations as quickly as the second child (Thelen & Corbetta, 1996). However, Thelen did not link these differences to the child's primitive reflex profile and the fact that the reflexes may have been at different stages of integration (Sugden & Dunford, 2007). Through her longitudinal study with infants and their

ability to make a stepping action, Thelen began to question the traditional view that the brain goes through a maturation process. Her research showed that new behaviours emerge through a self-organisation process where multiple components come together in that moment of time for the individual (Spencer et al., 2006; Thelen & Corbetta, 1996). Her description of the complex movement patterns humans develop became known as the Dynamic Systems approach (Thelen & Smith, 1994) and she believed that cognitive development originated in the extensive movement patterns made when the individual was an infant. Although she used observation rather than neuroimaging, her theory is close to the current understanding of brain development (Corbetta & Ulrich, 2008).

Thelen's (1996) theories on movement and developmental progression support the intervention (RMT) chosen in this research. Her Dynamic Systems Approach theory focused on the importance of the progression of movement infants make during their developmental journey. Choosing an intervention for this research based on the natural, independent movements babies make resonated with her theory. Thelen showed that babies work in multiple ways to achieve a goal. The RMT movements are not only based on the movements infants make, but the programme allows children some flexibility to choose the order, or even which movements they complete. Viewed as a strength of the RMT programme this allows for some input from the individual doing the movements and acknowledges Thelen's theory that the movement path of each child needs to be allowed to differ. Giving the child some control over their movement programme sets RMT apart from other movement programmes, which prescribe what movements the child is to complete and the order in which they are to be completed.

Uri Bronfenbrenner (1917 – 2005). A holistic approach to the development of a child was the basis of Bronfenbrenner's theory (2005). He developed his theories between 1973 and 2006, and what started out as an ecological approach to human development, moved to a bio-ecological approach in its third phase (Onwuegbuzie, Collins, & Frels, 2013; Rosa & Tudge, 2013) as is shown in Figure 2.3. The first phase of Bronfenbrenner's theory positions the child within the context of the systems or environment that they interact with and the relationships between those systems. The closer the system is to the child, the greater the impact, although Bronfenbrenner highlighted the fact that external influences can still affect a child's development. Microsystems

have the greatest influences on the child, for example, parents, siblings, or school. The child is in direct contact with those microsystems (Cicchetti et al., 2000). The mesosystem is the relationship between at least two microsystems, for example, the relationship of the parents with the child's school. The exosystem is described as an ecological system that has possible influence but does not directly interact with the child. Examples of this system are the workplace of a parent and its influence on the family or government policy that may effect the child (Rosa & Tudge, 2013). Institutional systems of a culture such as political, economic, social, educational, and legal systems form the macrosystem. Bronfenbrenner (1997) stated that the functioning of lower systems, micro, meso and exo-systems was influenced by the higher macrosystems. Belief systems and ideology also fall within the macrosystem system.

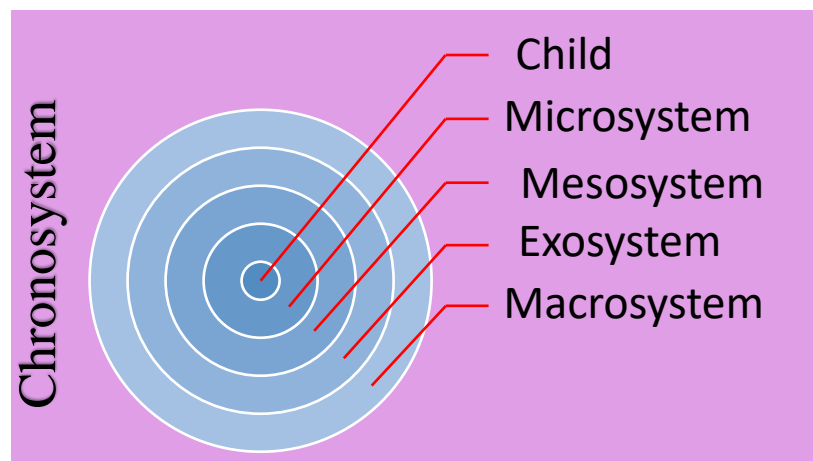


Figure 2.3. Bronfenbrenner's bio-ecological theory of child development.

Having identified the systems above, Bronfenbrenner (2005) continued to refine and develop the model. He moved to his second phase where he studied the importance of the individual within the development process and from this, he developed his process-person-context model. In his third phase of the theory development, Bronfenbrenner (2005) added time, which formed the Chronosystem, as an influence on human development and relating to the historical time a person is developing within, for example, a time of war or famine. These processes were named as a bio-ecological theory. He described proximal processes: the drivers of development, and he emphasised the role of the individual in their own development. These proximal processes not only allowed for the consideration of the influence of the parent workplace, but also the beliefs or opinions of the parent that may influence how they react to the workplaces situation, which in

turn may then impact on the development of the child (Rosa & Tudge, 2013). The ‘person’ aspect of the theory considered the characteristics of the person such as gender and biological condition, but also their disposition, resourcefulness and temperament. Bronfenbrenner identified the importance of the interaction between the individuals and the processes they had direct contact with, along with the context of the interactions (Rosa & Tudge, 2013).

Bronfenbrenner’s bio-ecological theory (2005) positioned a child’s development within the community and its complexity of relationships. His process-person-context-time (PPCT) theory fits well with this research question, forming the basis of some of the questions asked in the semi-formal interviews. The processes involved in a child’s birth, the level of maternal stress and the time of the birth (*close to an earthquake*) have all been suggested as possible causes in the interruption of the primitive reflex integration process (Goddard-Blythe, 2008; Goddard, 1996). The effectiveness of RMT relies on support for the child from teachers, parents and caregivers and it is important to explore how the adults have found the process (Koh et al., 2010). This relates to the context aspect of Bronfenbrenner’s theory. Paige-Smith and Rix (2006) emphasise the importance of the parent’s perspective in interventions, and a qualitative process allows their experiences to be explored. Bronfenbrenner’s (2005) theory highlights the multiple influences on development and informs the approach taken to formulating the research question and supplementary questions in this research. Qualitative research also supports a holistic approach, allowing the social and cultural context to be an important consideration in defining the research and making the findings context-specific (Bogdan & Biklen, 2007).

Lev Vygotsky (1896 – 1934). Vygotsky’s theories were written in the 1920’s in Russia, although his child development and education theories were not published in the Western world until the 1960 and 70’s. As one of the key socio-cultural theorists, Vygotsky’s theories were shaped by his interest in psychology and his experience as a special education teacher (Smidt, 2009). He examined society and history which led him to examine how children develop and learn. Through his observations and research he developed a theory based on the belief that all learning was social, human activities were grounded in cultural contexts and they were mediated by tools such as language (Daniels, 2017; Vygotsky, 1987). Three themes formed the core of Vygotsky’s work: a focus on biological or genetic processes which he referred to as ‘lower

processes' (Smidt, 2009; Vygotsky, 1978), a belief that higher intellectual processes have their origin in social interactions and in order to understand intellectual processes, an understanding of the mediators (for example, language) is needed (Vygotsky, 1978; Wertsch, 1985). Vygotsky's views on the construction of knowledge are viewed as constructivist theories (Phillips, 1995). He believed that the learner actively participated in the learning within a social setting, although as Phillips (1995) concludes, the genetic/nature aspect of Vygotsky's theory is of equal importance.

Vygotsky believed that the mind used tools to engage with and make sense of the world. While he considered language was the most commonly used tool, Vygotsky identified three categories of mediators: material tools, psychological or cultural tools and other humans (Schneider & Watkins, 1996; Smidt, 2009; Vygotsky, 1987). The material tools used by our predecessors' to interact or master nature (Daniels, 2017; Vygotsky, 1978) may have been wooden sticks; today a lap-top is one of our material tools. Cultural or symbolic tools that allow us to abstract include: numbers, music, art and language, which according to Vygotsky were part of higher intellectual processing. Vygotsky believed that there was a deep connection between language (the spoken word) and thought (inner speech) (Smidt, 2009) and these abilities of humans increased higher intellectual processing.

In his series of lectures published in *Thinking and Speech* (Vygotsky, 1987), the concept that children living in their sociocultural environment (home or school) gathered information from those around them who may have greater knowledge or experience was proposed. This person was termed the 'more knowledgeable other' (MKO) (Vygotsky, 1987) and included parents, teachers, older adults and peers. This places an importance on the social context of learning and the community the child is within (Smidt, 2009) as they develop knowledge. Vygotsky also placed emphasis on cognitive development being shaped by culture, the MKO in one culture will have a different knowledge base to that of an MKO in another (Daniels, 2017; Vygotsky, 1978).

Vygotsky also identified the Zone of Proximal Development (Kozulin, 2004; Vygotsky, 1978; Wertsch, 1985) where the child benefits by having others with greater knowledge guide and assist with challenging tasks. Vygotsky sees this place as the optimal zone for cognitive development (Kozulin, 2004). Daniels' states:

Firstly, Vygotsky defines the concept of the zone of proximal development (ZPD) as the distance between the child's 'actual development level as determined by independent problem solving' and the higher level of 'potential development as determined through problem solving under adult guidance or in collaboration with more capable peers' (Vygotsky 1978, p.86) (Daniels, 2017, p. 4)

Due to Vygotsky's death at a young age in 1934, the ZPD was not explored extensively, but according to Edwards (2017), the concept has been useful for educators as they explore the nature of relationships in the classroom and the processes involved in taking a learner from one point to another.

Vygotsky's theories on development align with the design and theoretical framework of this research. The classrooms that RMT was placed into were socio-cultural environments where children participated in their learning and the MKO (teacher) was asked to present the RMT movements. Children with retained reflexes often display behavioural immaturity (Konicarova & Bob, 2012) resulting in a reduced ability to interact with peers. This lowered level of social interaction may have the capacity to impact cognitive development. With Vygotsky's sociocultural theories in mind, data relating to behaviour and social and emotional development was gathered in this research (Vygotsky, 1978). If RMT can improve behaviour and the resulting improved behaviour leads to improved social skills, then Vygotsky's theory suggests that this will improve cognitive development. The behavioural aspects of this research are based on this theory.

2.7 Summary of Chapter 2

Neuroimaging has confirmed and expanded the knowledge surrounding brain development. Neural networks are being established in the infant's brain before birth and experiences help the brain develop at increased rates after birth. It has long been accepted that primitive reflexes play an integral part in a child's early development. The primitive reflexes are expected to integrate within the first year of life, and when this process is interrupted, educational and behavioural delays have been observed. Programmes to encourage primitive reflex integration have been developed, usually based on observed movements made by new-borns.

While extensive searches were made, there appears to have been no research using brain imaging to compare brain functioning of children with multiple retained primitive reflexes and children with integrated primitive reflexes. Do their brains work the same as children without retained primitive reflexes or differently? This question is not being answered by this research. Peer-reviewed literature relating to the effectiveness of RMT could not be found, neither could the voice of teachers in relation to reflex integration programmes and how such programmes can be integrated into the classroom setting. This current research has focused on these two aspects: does RMT encourage improved student achievement and behavioural outcomes, and is it easy to use within the classroom setting?

The following chapter outlines the methodology used in this research. Assessment of outcomes relating to the use of a primitive reflex integration programme are described, along with the theoretical basis on which the methodological decisions were made.

Chapter 3 Methodology

3.1 Introduction

This chapter describes the methodology used in this research and the methods used to gather and make sense of the data. The theoretical framework, reviewed in Chapter 2, has provided the base for methodological decisions described in this chapter. These processes increase the transparency of the research and the possibility for replication. The theoretical positioning has given information as to how the main research question was developed and then addressed. This chapter provides detailed information about qualitative and quantitative data gathering as well as analysis strategies. Discussed in the final section are ethical issues and Education Research Human Ethics Committee (ERHEC) approval.

3.1.1 Research Questions

This research investigated the RMT programme in relation to its influences on student achievement and behavioural outcomes.

The main research question for this research was:

What influences does the use of Rhythmic Movement Training (RMT) have in a classroom?

To assist in answering the main research question the following supplementary questions were asked:

- *From a teacher's perspective, how does RMT facilitate the achievement of curriculum goals?*
- *From a teacher's perspective, how can RMT be managed within the physical classroom space?*
- *What influence does participation in an RMT programme have on **student achievement**: reading, writing and mathematics?*
- *What influence does participation in an RMT programme have on **student behaviour**: social and emotional?*

3.2 Research Overview

This section gives an overview of the methodology used in this research shown diagrammatically in Figure 3.1. A theoretical framework, like an umbrella, is an over-riding cover that protects and supports the material beneath. However, in this research, the theory (pragmatic paradigm – focused on “What” and “How”) (L. Cohen et al., 2011) has been positioned within a rainbow structure and defines the mixed methods design selected. The image of the rainbow and how it relates to the research is described.

Investigated using a mixed methods approach, the research questions in this research deployed a phenomenological framework. A convergent design was used – similar to the methodology used by Klinger and Boardman (2011). Using this approach, the research questions remained in focus as data were collected. The process can be confirmatory or exploratory. Teddlie and Tashakkori (2008) define qualitative data gathering as predominantly exploratory, where a theory is being developed, and quantitative data gathering as confirmatory, where a theory is verified. Mixed methods design uses narrative and numbers to support each other. The convergent design used in this research allowed two strands of data, qualitative and quantitative, to be collected alongside each other, as well as sequentially timed interviews. Insights about the impact of RMT on behavioural and academic progress, and the ease with which it can be used in the classroom were explored through the two processes.

Figure 3.1 contains symbolism that positions this research. The lines and structure of the rainbow represent the scientific approach in the design, namely positivism (an approach of gaining knowledge through observation and experimentation – looking from outside to inside), as identified by Cohen, Manion and Morrison (2011). The lines of the rainbow also represent numeric quantitative data and the structure of the rainbow provides a framework to assist understanding of the results gathered. The colours of the rainbow are used in the order they are found in nature and are symbolic of the naturalistic approach (understanding and interpreting individuals in order to make sense of the world – looking from the inside to the outside) found in qualitative data as described by Creswell (2013). The colours inside the structure support each other, thus influencing the appearance. It is the colour that defines the rainbow – with no colour the lines have less meaning. For the naturalist, the perceptions of the individual, the words they

say and the way they say those words give meaning to whatever is in focus. In a similar way, educational research needs the theoretical framework to shape the design and the design to shape the methodology. Quantitative data gives structured results and qualitative data adds depth, meaning, richness, interpretation and perspective. At the bottom of the rainbow, the research is supported by four theorists: Bronfenbrenner (1997), Thelen (1996), Hughlings-Jackson (Franz & Gillett, 2011) and Vygotsky (1978). These developmental theorists added meaning to the way the research question, findings and results were formulated. Finally, the phenomenon in focus is RMT and as white reflects all the colours in the light spectrum, so will the findings and results relating to the use of RMT reflect all the aspects of the research design.

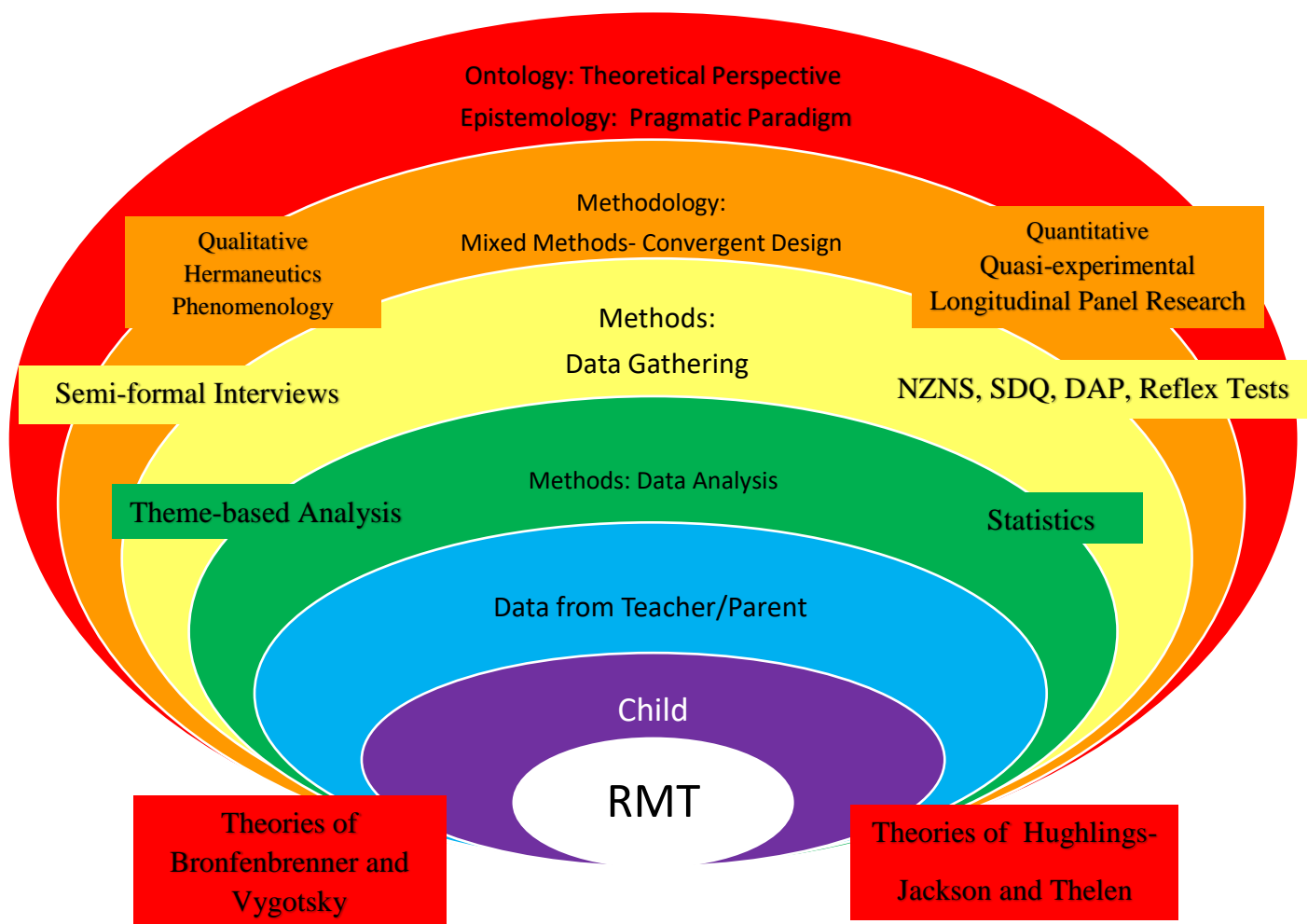


Figure 3.1. Research overview: Theoretical framework

On rare occasions, it is possible to see a rainbow make a complete circle. The symbolism of the missing section of the rainbow circle fits with the hermeneutic circles described below, and the whole-part-whole theory. Rather than research that takes linear steps in understanding, the researcher views the primitive reflex process in a more circular, interpretive way, along with the understanding of RMT and its use in the classroom. The diagram began as a simple rainbow with a few descriptives, but as the research process developed, additional components were added. The final diagram has a degree of messiness within the structure. This messiness represents the complexity of a hermeneutic approach as described by van Manen (1997), where there is a 'whole' and within that are the 'parts' which create greater understanding, through interpretation of the 'whole'. With the overall structure of the research design in place, each component will now be described in detail, to provide transparency of the processes used and thus increase the reliability and validity of the research.

3.3 Research Design: Mixed Methods

This section describes the mixed methods research design used in this research and gives explanations as to why the design draws qualitative and quantitative research traditions together. The presentation of the material in this chapter is the basis for the structure of the findings and results in Chapters 4 and 5. Qualitative perspectives and understandings are presented first, followed by the quantitative aspects of the research.

3.3.1 Mixed Methods: Convergent Design

A convergent mixed methods design was used in this research. Within mixed methods research, the order in which the data is gathered determines the design (Klingner & Boardman, 2011). A convergent design (Creswell & Plano Clark, 2011) allows both the qualitative and quantitative data to be collected concurrently and sequentially, thus allowing comparison and relationships within the data to be interpreted as is shown in Figure 3.3. Using quantitative data gathering allowed for a larger sample size ($n = 98$) and this is considered statistically useful (L. Cohen et al., 2011). Cohen et al. suggest 30 individuals as a minimum sample size in each group, and as is shown in Section 3.4, the make-up of the groups in this research exceeded that number.

Data analysis within a convergent design is completed separately but the results are merged to create an overall interpretation. This approach is considered appropriate when deeper understanding of an issue is being explored, and qualitative data can strengthen the quantitative results or vice versa (Creswell & Plano Clark, 2011). A convergent design is often viewed as part of a triangulation process. The data are collected independently and used to complement each other, thus increasing the validity and trustworthiness of the results (Creswell & Plano Clark, 2011). During this research, the data was collected concurrently and sequentially as the quantitative information was independent of the information given by teachers and parents. As shown in Figure 3.5, field notes and observation were made during the testing and movement phases. The testing took place at three time points and the interviewing took place near the end of the intervention phase.

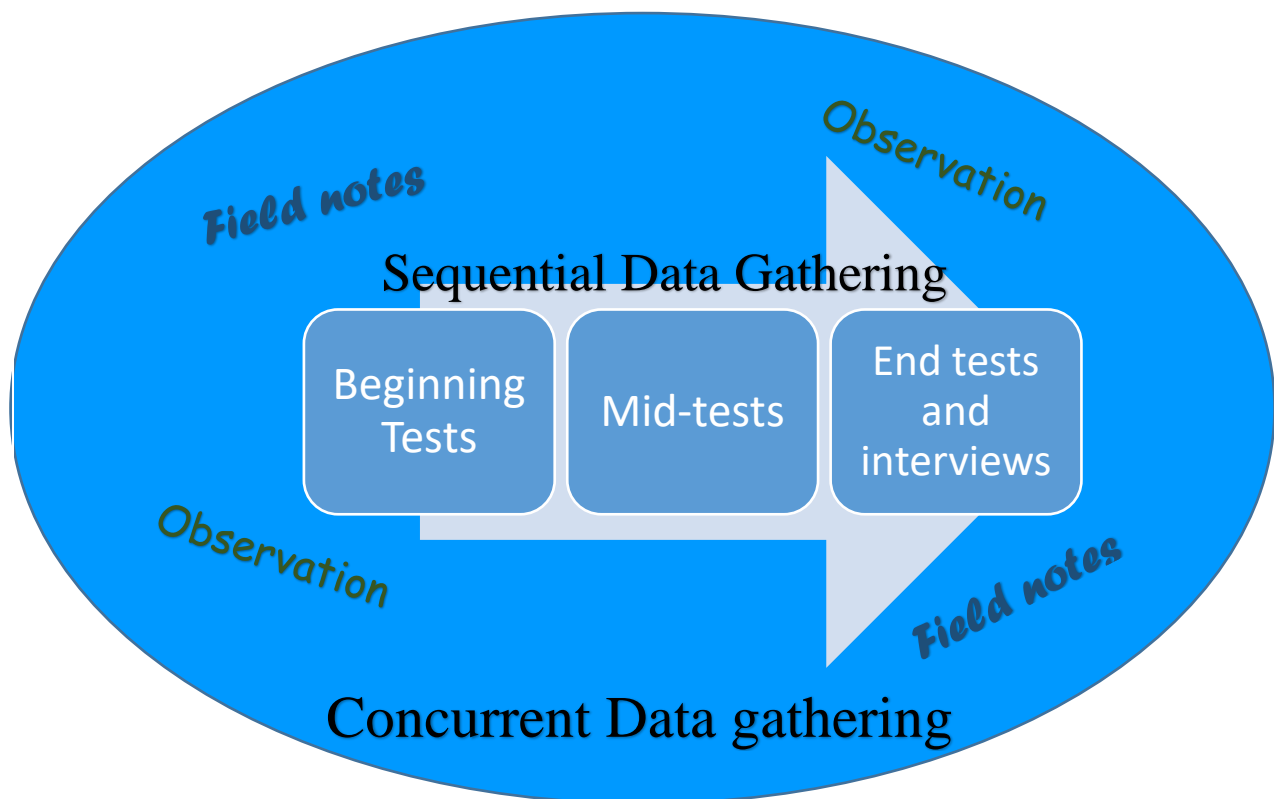


Figure 3.2. Sequential and concurrent data gathering points of RMT research.

The qualitative interview data described in Section 3.4, gave additional meaning to the quantitative results. The approach was intended to give a deeper understanding of the use of

RMT within the classroom setting. In this case, the quantitative results tell part of the story and the qualitative findings tell another part. RMT may achieve results, but if it is difficult for a teacher to use then this is important information. Conversely, RMT may be easy to implement within the classroom, but if results show minimal progress then the time may be better spent completing another activity.

Several approaches can be used in mixed-methods research when combining qualitative and quantitative data. Researchers can merge both data in some form by, for example, connecting the data through counting of themes and giving the qualitative data quantitative treatment (Creswell, 2009). This approach was not used in this research. The qualitative data were reported using descriptives and the quantitative data were placed alongside those narratives. The strength of the research is seen in weaving both with opportunities to provide additional meaning and insight to the results. As described above, in this converging process: there were two strands of data, and they support each other's findings (Creswell, 2009). It is possible in mixed-methods research to give one data strand greater weighting, but in this research, the two strands have been given equal weighting to ensure a deeper understanding of the use of RMT in the classroom.

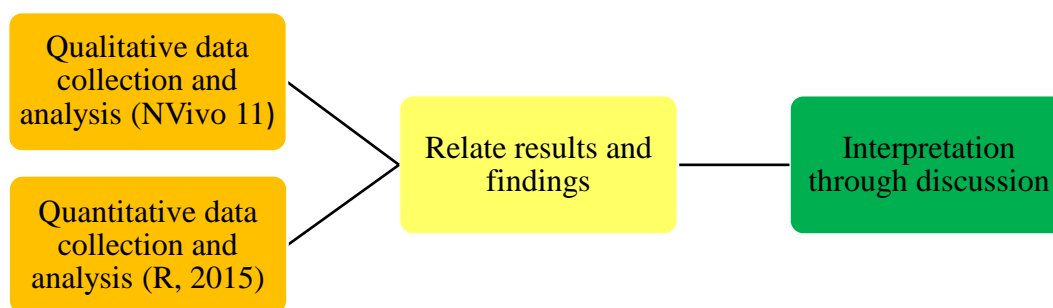


Figure 3.3. Convergent design process.

3.3.2 Quasi-Experimental Longitudinal Panel Research

Experimentation using pre-existing groups such as a school-based class is common in educational research (Drew, Hardman, & Hosp, 2008). These studies are known as quasi-experimental design studies, where the participants have not been randomly selected and the

researcher is not able to fully manipulate the variables (L. Cohen et al., 2011). Developmental research in education often uses quasi-experimental design because comparisons are made across groups that have pre-existing differences, such as those found in a class (Drew et al., 2008). Multiple baseline designs allow for a control to provide a comparison to an intervention group. In this research, the children were divided into two evenly matched groups and group 1 ($n = 52$) participated in the intervention, while group 2 ($n = 46$) was the control. The New Zealand Association for Research in Education (NZARE) wrote ethical guidelines in 2010. Under their general principles 2.6 “The rights and welfare of learners, research participants and the public should take precedence over the self-interest of members of the Association (*i.e. researchers*)” (New Zealand Association for Research in Education, 2010, p. 55). With this in mind, after five months the control children joined the intervention so that every child had an opportunity to experience the movements as outlined in Figure 3.4.

	Phase 1					Phase 2					
Intervention Group 1	Test	Movements 5 minutes per school day			Test	Movements 5 minutes per school day					Test
Control Group 2	Test	Normal programme			Test	Movements 5 minutes per school day					Test
Month	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Figure 3.4. Intervention activity during phases.

The overall structure of the research was a longitudinal panel research design. Cohen (2011) describes a panel study as one that collates quantitative data from a group of participants where information is gathered over an extended period. The participant group is the same throughout the research and the same data gathered several times. The longitudinal aspect (time) can range from several weeks or months to many years. This research design is useful when an investigation of possible causal patterns or inferences is undertaken (L. Cohen et al., 2011). There can be problems associated with participant response rates as is discussed by Laurie and Scott (1999) who suggest strategies to reduce the drop-out of participants such as maintaining accurate contact details. This research used the same participants for the data gathering period

(10 months) and the same data was gathered multiple times in relation to primitive reflex retention scores, Draw-A-Person (DAP) (neurological development) scores and academic achievement scores.

3.3.3 Qualitative Data: Hermeneutic Phenomenology

Traditions vary within the qualitative approach to research described in Section 3.1 (Creswell, 2013; Denzin & Lincoln, 2011; Yin, 2011). Examples include:

- storytelling in narrative research where life histories can be recounted
- ethnographic research which attempts to make sense of behaviours and patterns through descriptions and interpretations of an entire group of people
- grounded theory research which develops a theory based on an individual
- case study research which explores a ‘case’ (single case or multiple cases) within its normal setting
- phenomenological research, used in this research, which examines through interpretation of description, a specific phenomenon (Creswell, 2013, pp. 104 - 105).

Phenomenology as a Methodology. Phenomenology, used as the basis of the qualitative data gathering process in this research, is considered to have first developed as a philosophy. The word *phenomenology* is derived from the Greek word *phenomenon* which means “to show itself”, to shine a light on something so that it becomes visible (Ray, 1994). From the philosophical movement came the phenomenological method or approach to research (M. Cohen & Omery, 1994). The philosopher Husserl first used phenomenological research at the beginning of the 1900’s (L. Cohen et al., 2011). The basis of the methodology was to question assumptions and common sense associated with everyday life. The resulting data facilitated the investigation of experiences of the participants, namely perceptions and attitudes of their lives. Taking a group of individuals and exploring a phenomenon through the meaning of a common set of experiences differentiates phenomenological studies and other forms of qualitative research. A lived experience such as childbirth may be the phenomenon in focus or it may be something that all humans can experience (Creswell, 2013) such as happiness or the experience children using RMT movements gain as is the case in this research. However, it recognises that it is difficult to

generalise or “prove” that one method is more effective than another (van Manen, 1997) and it does not set out to solve a problem. The data analysis maintains a focus on the chosen phenomenon, with developing themes emerging (Bogdan & Biklen, 2007).

The two phenomenological approaches considered for this research were: hermeneutic phenomenology (van Manen, 1997), (interpretive), and transcendental psychological or empirical phenomenology (Moustakas, 1994) (descriptive). The approach best suited to this research was hermeneutic phenomenology as described in the next section.

Hermeneutic phenomenology. The specific characteristics of hermeneutic phenomenology and its approach to the research process align with the complexities of primitive reflex integration and the use of intervention programmes. Malpas and Gander (2015) describe hermeneutic phenomenology as the ‘art’ of interpretation while van Manen describes it as “a human science which studies persons’ (1997, p. 66). The latter highlights that it is the uniqueness of the person that is being studied rather than a generalised version of people. The word hermeneutics was used as early as the 17th century as a method of interpretation for biblical and classical text. Humans use language or text to make sense of their world, thus increasing knowledge and understanding (Dowling, 2004). Heidegger is credited as the developer of hermeneutic phenomenology (Malpas & Gander, 2015). He insisted that hermeneutics is a mode of interpreting, with emphasis on inquiry through self-reflective, interpretation from within the nature of being (ontological). Heidegger described a sense of “being in the world’ which he termed Dasein, subsequently guiding and interpreting research questions from this position (Ray, 1994). The key difference is that the researcher is ‘in’ the world instead of being ‘of’ the world. Gadamer built on Heidegger’s philosophy through his text *Truth and Method* (Gadamer, 1975b). He believed that ‘being there’ was essential to understanding and interpretation relies on self-understanding. Questions arise for a researcher and an understanding is developed through a systematic interpretation of the question, using language to discover and convey the understandings (Malpas & Gander, 2015). Hermeneutics is also considered to have a circular aspect to the reflexivity – a ‘whole’ is broken into ‘parts’ and through exploration of the ‘parts’ the understanding of the ‘whole’ then changes (Kinsella, 2006). This process is revised over time to increase the opportunities for understanding and greater interpretation (Malpas & Gander,

2015). By applying this circular aspect of hermeneutics to this research, a clearer picture developed as illustrated in Figure 3.5.

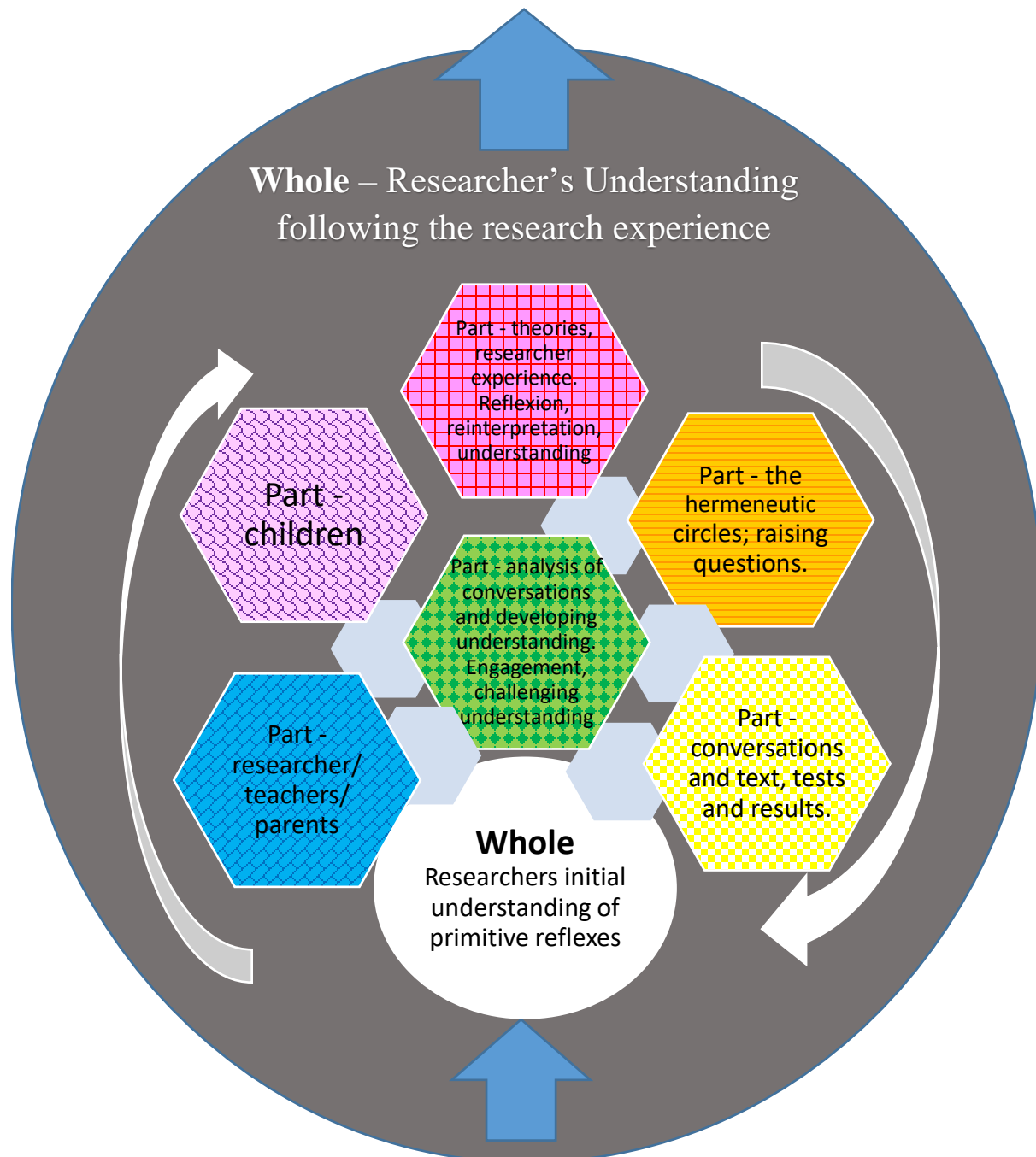


Figure 3.5. The Hermeneutic Circle as it applies to RMT.

In hermeneutic phenomenology the researcher starts with what they know, their ‘prejudices’ (as Gadamer (1977) describes the previously known meanings and pre-judgements) as well as their way of being and understanding. Through the hermeneutic process, what the researcher knows

and questions is then investigated through a series of ‘parts’ that includes the researcher engaging themselves within the context (participants, phenomenon) and the processes (text – via interviews, transcriptions, observation, insights) to arrive at a different understanding. There is a ‘fusion of horizons’ where past experiences are merged with the present understanding resulting in new meaning of the lived experience (Gadamer, 1977). This relates well to the rainbows in the theoretical framework described at the beginning of this chapter. Figure 3.5 illustrates that what started as some knowledge about something (white), through a series of processes ‘parts’ (different colours) then became the whole again but a different colour from the start. The grey colour in the big circle (Figure 3.5) represents the circular process, where it is possible to gain more understanding, but to understand everything the outside circle would need to be black. The arrows within the grey circle represent the repetitions of the researcher moving from the ‘whole’ to the ‘parts’ and then to the ‘whole’ again. Multiple opportunities to engage with the parts increases the depth of the understanding. The ‘whole’, in the hermeneutic circle, is looked at through the ‘parts’ and the ‘parts’ are looked at through the ‘whole’. The texture in the ‘parts’ (Figure 3.5) indicates that within the parts there are also additional parts that make up that ‘whole part’, which become part of the bigger ‘whole part’. Van Manen (1997) discusses the importance of the ‘whole’ and states:

Much of educational research tends to pulverize life into minute abstracted fragments and particles that are of little use to practitioners. So it is perhaps not surprising that a human science that tries to avoid this fragmentation would be gaining more attention (1997, p. 77).

This research utilised the hermeneutic circle to gain greater insights into the experience of RMT (Figure 3.5). There were shifts in thinking through the interpretation of the parts (a comment, some literature or an observation may have been the trigger) and then the ‘whole’ was revisited to reassess the researcher’s own experience or understanding. In other words, a process of cycling through the connections between research, observations and conversations.

Gadamer’s (Gadamer, 1975a, 1975b, 1977; Kerdeman, 1998) hermeneutic focus was on self-development. Acknowledgement of this within this research was recognised in Chapter 1 with the researcher’s Intellectual Autobiography. Transcendental phenomenology as described by Moustaka (1994) has a focus on descriptions of participant experiences, with minimal researcher interpretation. Husserl’s (Creswell, 2013) concept of **epoche** involves bracketing – a situation

where the researcher examines the perspectives of the participants, although to obtain a fresh perspective their own views and experiences are set to one side, thus likened to a ‘bird’s eye’ view. For the researcher involved in this research, it was considered unrealistic to attempt to bracket herself as in Moustakas’ (1994) approach, after acknowledging her breadth and depth of experience with RMT.

Hermeneutic phenomenology described by van Manen (1997) gathers data about participant’s lived experience (phenomenology) and interprets the texts/language (data) of life (hermeneutics). He views this approach as “fundamentally a writing activity” (van Manen, 1997, p. 77). Understanding the experience through the eyes of the participant, the language they use to describe the phenomenon and the interactions between all involved are valued. The perceptions of the participants form a socially constructed reality. The phenomenon is described, but there is an emphasis on emergent themes and the interpretive process that subsequently offers greater meaning of a lived experience (van Manen, 1997). Intentions of the ‘actors’ in a situation are recovered and reconstructed and the interactions help recapture meanings. Merleau-Ponty (Boden & Eatough, 2014; Merleau-Ponty, 2004) has contributed to the thinking around phenomenology, with Macann (1993) describing his approach as “reflective interrogation” and the ability to “reflect on the unreflected” (p. 162). The importance of using language as a tool for expressing an experience was also highlighted by Merleau-Ponty (van Manen, 1997). The researcher needs to separate the essence from the experience through a structured analysis of the language used to describe the experience. Boden and Eatough (2014) state that within hermeneutic phenomenology, subscribing to a ‘bird’s eye’ view is not possible because the researcher and the participants are enmeshed in their world and therefore have perspectives about the phenomenon in focus. Interpretation is inevitable and as the phenomenon is described to the researcher, the interpretation may differ, based on previous experience, to that of the participant. The participant has interpreted their experience, but two participants could possibly interpret the experience differently. Such is the human condition.

Within hermeneutic phenomenology, it is possible that multiple voices co-exist. These voices may be in relation to shared experiences and both voices can have equal value as the meaning is investigated. Lindseth and Norberg (2004) state that in order to understand text the researcher

needs to move “from what it says - to what it talks about” (p. 146). The researcher is not looking for external objects to obtain meaning, rather they are working to discover the meaning itself through participant experience and reflective insight. Gadamer (1975b) places importance on the question being opened up and remaining open while the possibilities are explored. According to van Manen (1997), the researcher needs to be an active participant in this process.

Hermeneutic research also acknowledges that all interpretation has a perspective. The role of the interpreter is seen as critical in hermeneutic interpretation, including their prejudices and history that shapes their range of experiences (Kinsella, 2006). Acknowledged in this research is the researcher’s experience with retained primitive reflexes in both personal and professional capacities. This has shaped the ‘worldview’ that this researcher brought to the research.

Following consideration of the different phenomenological approaches, there is acceptance of a focus on the experience of the participants and interpretation of their experiences. The parents have lived with children who have used RMT and their perceptions are of value when attempting to understand their children’s involvement with RMT and the outcomes parents experienced. The teachers ‘experienced’ RMT in the classroom and they ‘experienced’ having children in their classrooms who had used the programme. Their lived experience is valued as part of the process of understanding RMT within a classroom setting. As naturalism is part of this research’s theoretical framework, hermeneutic phenomenology fits well within the methodology. The design of this research enabled the gathering of information from parents and teachers through semi-formal interviews. The information was analysed and the themes that emerged provided rich descriptives of their experiences. The process of data analysis is described in Section 3.2. Using her previous experience with children’s development and RMT, data from parents and teachers was interpreted by the researcher. However, challenges within the approach are highlighted in the next section.

Challenges within hermeneutic phenomenology. Hermeneutic phenomenology has attracted criticism from within the scientific community (Gadamer, 1975a). Kinsella (2006) notes that although there is an elusive nature to the method it is the ambiguity of the process that allows for greater understanding. Language is central to hermeneutics and according to Cohen and Omery (1994), the language of phenomenologists can be viewed as unclear, messy or vague.

They note that when researchers attempt to fit into scientific or academic norms such as step-based processes or space constraints, the essence of the phenomenology will be diluted. Gadamer (1975a) acknowledges that science prefers to eliminate uncontrollable or unobjectifiable elements in research. However, as Gadamer discusses, Aristotle alluded to the need for a method of dealing with social research that acknowledged the researcher's part in the society they were researching. Within the hermeneutic approach, the focus is on understanding the data rather than explaining it, being reflective so that the insights are determined by the interpretations of the person doing the reflection and their experiences. The range and previous experience of the researcher has an impact on the depth of reflection. Because this is a personal journey, that would not be viewed as a limitation. Would another researcher with different experiences arrive at different interpretations? In hermeneutic phenomenology this would be viewed as a different part of the whole, however, within the scientific community, this may be interpreted as a dilution of the results because they are different.

Philosophical concerns have been highlighted by Ray (1994). She states that understanding the philosophical basis of phenomenology determines the success of the research and she highlights the notion that not all qualitative research is phenomenological in the approach – a mistake she believes is made by some researchers. The sections above describing phenomenology and hermeneutics are intended to provide a clear philosophical and methodical positioning of this research.

Another area of concern in hermeneutic phenomenology is within the methodology of the research. A transformative experience is often at the centre of the research with the researcher's interest lying within the experiences of the participants (Ray, 1994; van Manen, 1997). The interview questions seek to gain meaning about the experience and the data analysis needs to be a reflexive process with thematic interpretation and insight in focus. It is important that the researcher retains the interpretive nature of hermeneutics in data gathering and the discussion of results. Van Manen states that:

Phenomenology is not an empirical analytic science. It does not describe actual states of affairs; in other words, it is not a science of empirical facts and scientific generalisations, asking who did what? When? Where? How many? To what extent? Under what conditions? And so forth (van Manen, 1997, pp. 21 - 22).

He also states that the method does not make sense of the world through speculative inquiry and it does not solve problems. The aim is to highlight the lived experience of the person involved through gathering history, understanding and descriptives. Value is placed on the subjective human behaviours gathered through text. There is no need to generalise or categorise the experience within a population (Guba & Lincoln, 1989; Ray, 1994).

Within this research, the challenges of hermeneutic phenomenology have been carefully considered. The thematic interpretation of the text has been used as the basis for the results and discussion so that the reader is aware of the importance placed on the perspectives of the teachers and parents. Children's developmental processes can appear unclear as they don't all follow a pre-determined pattern, and although there are similarities, one child's reaction to a situation may differ markedly to another's. In a similar way, teachers within a classroom will have very different experiences and a classroom does not stand in isolation from the participants or its community. For these reasons the ability to capture a range of perceptions with an ability to interpret these was viewed as an important as part of the RMT experience. The following section describes and justifies the method of hermeneutic data collection used in this research.

Data collection: Semi-formal interviews. Interviews are widely used in qualitative research as an effective data collection method. A commonly used process in hermeneutic research is a semi-formal interview where questions are formulated, but digression is permitted to follow-on from comments made by the participant. Boden and Eatough (2014) explored multidimensional approaches to data gathering in their research, using bodily, visual and verbal data collection. Their research, involving perceptions around feeling guilty, asked participants to make drawings of the experience which they were then asked to interpret, they performed a fantasy enactment and they were involved in a semi-formal interview where the drawings and the dramatic enactment were reflected upon. While this is appropriate for an emotionally charged focus such as 'guilt' it was felt that a simple semi-structured interview with parents and teachers would be appropriate for the investigation of the RMT movements.

Obtaining accurate data is important in hermeneutic research-based interviews. There are several factors that a researcher must consider to ensure reliability and avoid bias. Developing rapport with the interviewee, asking questions in an acceptable manner and responding appropriately to

the answers given (L. Cohen et al., 2011) are critical in successful interviewing. The bias of the interviewer can be problematic and ideally there would be a range of interviewers with differing biases. In this research, the researcher completed all interviewing. Understanding and recognising bias or prejudices is important and having a range of pre-prepared questions may help reduce obvious bias (Creswell & Plano Clark, 2011). Within qualitative data gathering, it is expected the researcher will actively withhold personal opinions and viewpoints, so as not to sway the participant's view. The interview is a social construct where there is sharing of aspects of everyday life, and within that social encounter, there are perceptions, understandings and bias. Even though a researcher may work to remain objective and systematic, every interview will be influenced by the everyday life of both the participant and the interviewer (Bogdan & Biklen, 2007; L. Cohen et al., 2011). Within the hermeneutic interview, the researcher's understanding can be utilised through the questions that are asked. This is to facilitate the gathering of a greater depth of information from the interviewee (van Manen, 1997).

Semi-structured interviews as described by Bogdan and Biklen (2007) were used with the participants in this research. A set of pre-prescribed questions were developed, and these were emailed to the participant before the interview, allowing time for interviewee preparation. However, as part of the semi-structured nature of the process, the interviewer was permitted to follow a line of comments through additional questioning. This type of interview is not standardised, but the questions provide the ability to compare some data. Having a hermeneutic approach as part of the methodology, the need to be able to explore the perceptions of the participants was given greater value (Creswell & Plano Clark, 2011). With the individualised perceptions of children's development and the use of RMT, semi-formal interviews had the ability to gather a range of material that may have been missed through questionnaires. Probing questions, and taking opportunities for clarifying information provided opportunities for richer data to be gathered and increased opportunities for interpretation (L. Cohen et al., 2011). When participants talked about one topic it often triggered another related thought and it was important for them to be given time to relay their perceptions. The questions for teachers and parents related to the children. A starter question asked about their general perceptions of the year. The questions became more focused on academic skills, and sporting skills, followed by a question about socialisation. Then perceptions about the RMT programme were asked. Parents were

finally asked about their child's delivery/birth. This question was asked at the end of the interview when there had been time to build rapport and was focused on the child rather than the state of the mother. Parents could then choose how much personal information they gave. Appendices I and J have the full list of starter questions.

As the interviews were part of an embedded mixed methods design (Creswell & Plano Clark, 2011), their purpose was to provide information from a 'lived' experience (hermeneutics). The quantitative data described in Section 3.3 was then discussed alongside the comments from teachers and parents.

Field notes and research diary. Field notes and a research diary were used in this research. The experiences a researcher has while conducting interviews or visits to participants are collated in what are commonly termed 'field notes' (Bogdan & Biklen, 2007). The written notes are made from memory as soon as possible after the experience and contain perspectives gained, observations made (things experienced, seen and heard) and reflections that are the result of the data collection process. They typically contain descriptions of the people, the environment, activities and conversations and are reviewed when analysing qualitative data and discussing the findings. A research diary documents timing in relation to the research as well as ideas, reflections, insights and strategies that have surfaced through the research process (Nadin & Cassell, 2006). Nadin and Cassell describe how diaries are usually associated with sociology or ethnography, but their usefulness has been extended to other disciplines, including business management. A diary completed on a regular basis allows the researcher to reflect on interpretations and then repeat that process by reflecting further on interpretations of the interpretations. This is an important part of the hermeneutic approach where ideas are taken apart and the hermeneutic circle encourages interpretation of the parts in order to gain a greater understanding of the 'whole' (Gadamer, 1977). In this research, the field notes were written in the research diary so that the observations could be reviewed alongside the larger reflections and interpretations over the time of the research from inception to completion. The diary also contained useful information such as webpage information or contact details, where there was a possibility that the information may need to be revisited.

3.3.4 Quantitative Data

Quantitative data was gathered as part of this research. The data gathered using this method is considered to be part of a science-based experiment and gives scientific measurements and percentages of change, in this case, value added to student achievement. As a science-based method of gathering data, it is considered to provide reliable information on the efficacy of an intervention (L. Cohen et al., 2011). This section describes in detail the numerically based tests that were used in this research and the rationale behind their inclusion.

New Zealand National Standards testing: Reading, writing and mathematics.

Academic results in this research were based on testing completed by classroom teachers. The New Zealand National Standards (NZNS) were the system of assessment used in all New Zealand schools in 2017 when this research was conducted. The standards were launched in 2009 (Ministry of Education, 2009b) as a way of communicating student progress to parents and whānau (extended family) as well as providing standardised information for the New Zealand Government about achievement levels within schools. Schools were encouraged to use a range of testing to gather data. With schools slow to implement the system, the Government made their use compulsory in 2014. NZNS were based on guidelines provided by the Ministry of Education, with moderation being an important component of the process (Ministry of Education, 2011). There is debate as to the appropriateness of these standards for a country with such cultural diversity (Özerk & Whitehead, 2012) and in December 2017 the NZ Prime Minister announced that NZNS would be discontinued. However, for the purpose of this research, they were the assessments used in New Zealand schools at the time and the academic results in this research are based on the NZNS assessments completed by the teachers. This decision was made due to the extensive testing schedule within all schools as required by the NZNS, and it was believed that adding additional maths, reading and writing tests, three times during the year, when children were already being tested was not promoting well-being (Lazarín, 2014).

At the Year 3 level as part of the NZNS, Overall Teacher Judgement (OTJ) is used extensively in assessments. This means that the Ministry of Education is not able to provide statistical levels of reliability and validity. OTJ is based on teachers conversing with students, observing the processes the student uses and gathering results from formal assessments, including some

standardised tools (Ministry of Education, 2011). Moderation is an important part of the process; schools moderate within their own teams and between schools. The formal testing used by each school in this research is summarised in Table 3.1.

Table 3.1. *Specific Tests Used in Each School*

School Subject	Nikau	Kauri	Pōhutukawa
Reading	PM Benchmark Running Records, Star and Overall Teacher Judgement (OTJ).	PM Benchmark Running Records up to gold (L20 8yr reading level)) then Hilton Ayrey Prose Test from Gold L21 8yrs reading age and up and OTJ.	PM Benchmark Running Records and OTJ.
Writing	Schoolwide records of work aligned with National Standards, Team moderation and OTJ.	e-asTTle marking scale and OTJ.	e-asTTle marking scale and OTJ.
Maths	IKAN, Numeracy Project snapshots and OTJ.	JAM (junior assessment maths), GloSS and OTJ.	JAM, IKAN, and OTJ.

General information about each test is summarised in Table 3.2. All the tests used were on the Ministry of Education’s list of recommended tests to assess NZNS. Ministry of Education Assessment Resources Maps showing where each test lies on the NZNS framework are in Appendices Tm, Tr and Tw.

Table 3.2. *Details of Testing Used in Schools*

Test	PM Benchmark Running Records	e-asTTle	IKAN	JAM	GloSS
Subject area	Reading	Writing	Maths	Maths	Maths
NZ Origin	No, texts are trialled and levelled in Australia.	Yes	Yes	Yes	Yes
Standardised	No but texts have been levelled in Australia.	Yes	No, but national performance data is available.	No	No, but national performance data is available.
Availability	\$485 for one level.	Free from Min of ED website	Free from NZ Maths website	Free from NZ Maths website	Free from NZ Maths website
Recommended by Ministry of Education	Yes	Yes	Yes	Yes	Yes
Developed by	Price Milburn 2008	NZCER for the Min of ED, 2011	Numeracy Project, Ministry of Education 2002,	Ministry of Education 2011, updates 2014 and 2015.	Numeracy Project, Ministry of Education 2002, revised 2013.

Scoring of tests was done in the following way:

Reading: There are Levels 1 – 30 and all children’s scores were within this range. Within the first two years a child is at school there are nine reading levels for each year. Within the third and fourth years, there are four reading levels for each year. This structure was not statistically comparable. To enable the statistical model to work effectively the reading levels were allocated linear steps, 4 for each year of schooling. The scoring is shown in Table 3.3.

Table 3.3. Reading Scores Adjusted for Statistical Analysis

Reading level	Stats reading score	Reading level	Stats reading score	Reading level	Stats reading score
1-2	1	15 - 16	8	25	15
3-4	2	17 - 18	9	26	16
5-6	3	19 - 20	10	27	17
7-8	4	21	11	28	18
9-10	5	22	12	29	19
11-12	6	23	13	30	20
13 – 14	7	24	14		

Writing: As is shown in Appendix Tw, children in Years 2 – 4 are expected to be working at levels 1 and 2 of the New Zealand Curriculum Writing with some children possibly beginning level 3. There are three stages within each level, B = Basic, P = Proficient and A = Advanced and the range of scores was, 1B, 1P, 1A, 2B, 2P, 2A, 3B, 3P and 3A. For statistical analysis, the scores were assigned a numerical value from 1 – 9 as is shown in Table 3.4.

Table 3.4. Possible Writing Scores

Raw Writing Score	Pre-writing	1B	1P	1A	2B	2P	2A	3B	3P	3A
Statistical Writing score	0	1	2	3	4	5	6	7	8	9

Mathematics: As shown in Appendix Tm, children in Years 2 – 4 are expected to be working at levels 1 and 2 of the New Zealand Mathematics Curriculum. There may be some children working at levels 3 and 4. There are also Numeracy Strategy Stages that sit alongside each Curriculum level (Appendix Tm). Children in Year 2 – 4 are expected to be working at stages 4 to 5, although it is possible to have children working from Stage 1 through to Stage 7. The range of scores within the participant group was from Level 1/Stage 1 through to Level

4/Stage 6/7. As with the reading scores, each level was assigned a numerical score for statistical purposes. The range of scores is listed in Table 3.5.

Table 3.5. *Possible Mathematics Scores*

Level	Stage	Statistical Score
Pre-mathematics		0
Level 1	Stage 1	1
Level 1	Stage 2	2
Level 1	Stage 2/3	3
Level 1	Stage 3	4
Level 1	Stage 3/4	5
Level 1	Stage 4	6
Level 1	Stage 4/5	7
Level 1	Stage 5	8

Level	Stage	Statistical Score
Level 2	Stage 4/5	9
Level 2	Stage 5	10
Level 2	Stage 5/6	11
Level 2	Stage 6	12
Level 2	Stage 6/7	13
Level 3	Stage 6	14
Level 3	Stage 6/7	15
Level 3	Stage 7	16
Level 4	Stage 6/7	17

Reflex tests. Three reflexes, TLR, ATNR and Spinal Galant, were chosen for testing in this research. All three primitive reflexes have been used in other research and they appeared to assist in the answering of the research questions in this research:

- The TLR has been used by Goddard-Blythe (2005) and Grzywniak (2017) and is associated with the vestibular (balance) system, visual and auditory processing. While physical skills were not assessed in this research, the participants were in a classroom setting where visual and auditory skills were in constant use.
- The ATNR was used by McPhillips et al. (2000; 2004), Jordan-Black (2005), Goddard-Blythe (2005) and Grzywniak (2017) and has been associated by these researchers with academic outcomes, in particular reading. As reading, writing, and mathematics were tested, value was placed on aligning this research with work already completed.
- The Spinal Galant was used in research completed by Konicarova and Bob (2012). It is also associated with the vestibular system, as well as hyperactivity and inattention. As this research included the Strengths and Difficulties questionnaire (Goodman & Goodman, 2009; Ministry of Health, 2015b) where behaviours were assessed, value was placed on this reflex.

The reflex tests performed by the children described below are simple tests that require a round-ended stick or pencil to complete. Along with the relationship to the research questions, ease of testing was a consideration when choosing which primitive reflexes to test. As parents were not present during the testing, tests requiring the tester to touch the child were excluded. All tests were able to be demonstrated by the tester, and the child was then asked to imitate the action. The Spinal Galant test required the tester to run the pencil down the child's back, but only the pencil touched the child. Tests also needed to be able to be performed in the classroom. These factors were taken into account to ensure child safety. Reliability statistics were not able to be found, but in a review article, Zafeiriou (2004) says that primitive reflex tests "comprise one of the earliest, simplest and most frequently used tools among child neurologists to assess the central nervous system integrity of infants and young children" (2004, p. 11). The tests are used in medical settings when screening for cerebral palsy. As similar studies testing primitive reflex retention used the same tests chosen for this research, they were deemed to be the most appropriate tests available. The individual tests used in this research are described below.

Tonic Labyrinthine Neck Reflex (TLR) Test. The TLR test has been used in two studies (Goddard-Blythe, 2005; Grzywniak, 2017) although there are no reliability or validity scores. However, as with other studies, the test used by Goddard-Blythe (1996), her experience and expert standing in the field give it the credibility necessary in the absence of reliability or validity scores relating to the test (Appendix S).

- **Test** (Goddard, 1996): The child stands with their feet together and hands by their sides. The tester demonstrates the head slowly bending forward and then slowly bending back. The child is asked to complete this. The child is then asked to close their eyes and repeat the same movement. The tester is noticing any wobbling, disorientation, movement in the toes, tension in shoulders or neck and any involvement of the legs to aid stability.
Scoring: 0 = No movement other than the head, 1 = Slight balance adjustment when the head moves, 2 = Balance disturbed and/or muscles at the back of knee involved, 3 = Alteration of leg muscles and/or near loss of balance, 4 = Loss of balance.

Asymmetric Tonic Neck Reflex (ATNR). The Schilder test for ATNR has been used in several studies completed by researchers considered to be experts in this field (Brown, 2010; Gieysztor

et al., 2018; Goddard-Blythe, 2012; Jordan-Black, 2005; Konicarova & Bob, 2012; McPhillips & Jordan-Black, 2007a; McPhillips & Sheehy, 2004; Taylor et al., 2004). No reliability statistics were found for this test, but it has been used since 1985 with school-aged children and is the commonly recognised procedure for testing the presence of the ATNR (Livingstone & McPhillips, 2014). McPhillips believes that this ATNR test is a good indicator that other reflexes may be present (McPhillips & Jordan-Black, 2007b) and gives this as the reason for using only one test in his research (Appendix S).

- **Test** (Goddard, 1996): The child stands with feet together and hands by their sides. The tester demonstrates, arms straight out in front at 90 degrees to the body, eyes closed and then turn the head slowly to one side and then turn the head slowly to the other side while keeping arms still. The tester is looking for movement in the arms when the head is turning, and the child's ability to keep their balance. Scoring is as follows: 0 = no movement in arms when the head is turned, 1 = slight movement of arms, 2 = arms move 45 degrees in direction of where the face is pointed, 3 = arms move 60 degrees towards where the face is pointed, and 4 = loss of balance and/or arms rotated 90 degrees.

Spinal Galant Test. The Spinal Galant test has been used by Konicarova and Bob (2012) in their study relating to ADHD and the retention of reflexes, but again the test used is from Goddard's testing regime (1996). This study used Goddard's test in the absence of research relating to the reliability and validity of the test (Appendix S).

- **Test** (Goddard, 1996): The child kneels with hands and knees touching the ground. The tester shows the child the rounded end of a pen and tells them that they will feel the pen being run down their back. The pen is then run down the back, either side of the spine. The tester is looking for hip and shoulder movement. Scoring: 0 = no movement, 1 = hip movement or undulation of 15 degrees, 2 = hip movement or undulation of 30 degrees, 3 = hip movement or undulation of 45 degrees, and 4 = hip movement or undulation of more than 45 degrees with some loss of balance.

Draw-A-Person Test (DAP). The Goodenough Draw-A-Person test was used in this research. Goodenough (1931) developed this test in the 1920's and she provided examples of children's drawings noting that their construction aligned with the child's cognitive

development. This method of data gathering is used by psychologists and has been used in other educational based studies with children (Lange-Küttner, Küttner, & Chromekova, 2014; Merriman & Guerin, 2006; Williams, 2015) while Sisto (2000) also found a positive correlation (0.86) between the drawing of human figures and cognitive development. The original test was designed to be used with children under the age of 12 years (Prewett, Bardos, & Naglieri, 1988). Criticism has been raised by researchers when this test is used to indicate levels of IQ (Kamphaus & Pleiss, 1991; Lange-Küttner et al., 2014; Merriman & Guerin, 2006). However, in this study Intelligence Quotient (IQ) was not measured, just cognitive changes. Merriman and Guerin (2006) describe the DAP as a useful tool in this situation. The test-retest reliability has been measured at 0.74 (Kamphaus & Pleiss, 1991; Prewett et al., 1988) when the quantitative scoring system is used (Appendix R).

- **Test:** Children were provided with an A4 sheet of white paper. The paper had their name, their ID number and their School at the top of the paper and their ID at the bottom. The IDs and names were matched manually as the children's names were removed at the completion of the task. This ensured that names and IDs were matched correctly. Children were given the paper with their name on it and they were asked to check the name. The instruction was given "I want you to draw a picture of a person. Make the very best picture you can. Take your time and work carefully" (Goodenough, 1931). There was no time limit placed on the children and they took between 3 minutes and 20 minutes to complete their drawings. They were not asked to add body parts that were missing when they had finished their drawing. They were given pens and lead pencils and were asked not to colour their pictures. This was a time factor as once they started colouring there were more decisions to make about colour and this was not included in the scoring.

The scoring system devised by Goodenough was used (Porteous, 1996). Each drawing was given a mark for items included. For example: if the arms and legs are attached to the trunk, one point was given. Another point was given if a neck was present. These points were then translated into Goodenough's neurological age using the table associated with the test. For example, a score of 16 equated to a neurological age of 7 years on the scoring table. For further details see Appendix R. Table 3.6 groups the questions into the types of scoring used for each question, adding additional information as to how the judgement was made for the 'Judgement' questions.

Table 3.6. Draw-A-Person Test Scoring Based on Question Type

Area	Question Number	Description	Q Type	Interpretation
A	2	Arms and legs attached to the trunk at correct points.	Judgement	The correct point was established as being close to the shoulders at the top section of the trunk.
A	4	Outline of neck continuous with that of the head, trunk, or both.		
C	2	Two articles of clothing non-transparent (ex. Hat, trousers).		
C	3	Entire drawing free from transparencies – sleeves and trousers must be shown.		
C	4	Four articles of clothing indicated. *should include 4 – hat, shoes, coat, shirt, necktie, belt, trousers.		
FH	2	Ears present in correct position and proportion.		Top of ears needed to be in line with the eyes to score 1.
FH	6	Chin and forehead shown.		Examples of chin were the change in shape. The forehead was shown through the placement of hair.
GD	6	Shoulders are indicated (abrupt broadening of the trunk below the neck).		
HAN	4	The opposition of thumb clearly defined.		
HAN	5	Hand shown distinct from fingers and arm.		The fingers had to stop, and the arms start in a different place, leaving room for the hand.
HED	4	Nose and mouth in two dimensions, two lips shown.		
HED	7	Hair on more than the circumference of the head and non-transparent – better than a scribble.		
J	1	Arm joint is shown – elbow, shoulder, or both.		The elbow needed to be bent, or the arms were hanging close to the side of the body. Arms coming straight out from the body scored 0.
J	2	Leg joint is shown – knee, hip, or both.		
MC	1	Lines firm without a marked tendency to cross, gap, or overlap.		If most of the lines fitted this description the drawing scored 1.
MC	2	All lines firm with correct joining.		There could be no overlapping to score 1 for this question.
MC	3	Outline of the head without obvious irregularities. Develop beyond the first crude circle. Conscious control apparent.		There needed to be deliberate intent shown with the shape of the head to score 1.
MC	4	Trunk outline. Score same as #3.		
MC	5	Arms and legs without irregularities. 2 dimensions and no tendency to narrow at the point of junction with the trunk.		

MC	6	Features symmetrical (more likely to credit in profile drawings).		Any irregularities in the features scored a 0.
FH	5	Eye detail – proportion. Length greater than width.	Measurement	For these questions, a small flexible ruler was used to measure the drawings to ensure proportions were accurate.
GD	5	Length of trunk greater than breadth.		
HAN	3	Fingers in two dimensions - length greater than breadth, angle subtended not greater than 180 degrees.		
P	1	Head not more than ½ or less than 1/10 of the trunk.		
P	2	Arms equal to trunk but not reaching knee.		
P	3	Legs not less than trunk not more than twice trunk size.		
P	4	Feet in 2 dimensions – not more than 1/3 or less than 1/10 of the leg.		
A	1	Both arms and legs attached to the trunk.		
A	3	Neck present.	Yes/No	For these questions, a yes/no approach was taken. The quality of the offering was not judged. As examples, a representation of ears was given a 1, fingers were counted, and any mark indicating hair was given a 1.
C	1	Clothing present (any clear representation of clothing).		
FH	1	Ears present (2 in full face, 1 in profile).		
FH	3	Eye details – brow or lashes is shown.		
FH	4	Eye detail – pupil is shown.		
GD	1	Head present.		
GD	2	Legs present.		
GD	3	Arms present.		
GD	4	Trunk present.		
HAN	1	Fingers present (any indication).		
HAN	2	Correct number of fingers shown.		
HED	1	Eyes present (one or two).		
HED	2	Nose present.		
HED	3	Mouth present.		
HED	5	Nostril shown.		
HED	6	Hair shown.		
P	5	Both arms and legs in two dimensions.		

Qualitative data from the drawings included noticing the size of the drawing in relation to the size of the paper, unusual techniques used, specific body parts that are missing, or maybe comments the child made to the teacher while completing the drawing e.g.: “I can’t draw hands, will you draw them for me?” and the general appearance of the drawing was noted. This technique has been used in a therapeutic way with children’s drawings by Oaklander (1978) and the purpose was to add information about the drawing to the quantitative score given.

Strengths and Difficulties Questionnaire (SDQ). The SDQ was completed by teachers and some parents about the participating children. This child development screening questionnaire is recommended by the New Zealand Ministry of Health as a reliable, valid and sensitive method of gathering information about social and emotional development (Ministry of Health, 2014, 2015b). They recommend it as a preliminary information gathering exercise, to aid in the judgement of the need for further, more detailed assessment. Psychologists sometimes use the SDQ to establish if or what further investigation is appropriate in relation to the difficulties a child or family are experiencing. In this research, the questionnaire was not used in a diagnostic manner, rather as a way to gather additional information about children's development. Psychosocial attributes are the focus of the questionnaire, with both positive and negative behaviours, emotional maturity, peer relationships, conduct and levels of hyperactivity contained in the mix of questions (Goodman & Goodman, 2009). The test-retest reliability score for the test is 0.73 and although there are critics of the lowered reliability particularly when parents answer questions about younger children (below 0.70) (Stone, Otten, Engels, Vermulst, & Janssens, 2010), the reliability score increased (above 0.70) when teachers answered questions about children. The questionnaire information allows additional qualitative data to be gathered and using this approach with the SDQ is recommended by Stone et al. (2010). Ease of use for parents and teachers was an important consideration in this research, as the questionnaire needed to be completed twice, pre- and post-intervention. All teachers completed the SDQ using a class-specific excel spreadsheet constructed by the researcher. Parents were offered an emailed paper version of the questionnaire, or a link to the same online version of the questionnaire through the Qualtrics website. One parent used paper and all others used the online version.

Once completed the test results were placed in a database and assessed using a linear mixed effect model of analysis as described below. Appendix N shows the five areas of emotional symptoms assessed: emotional problem scale, conduct problem scale, hyperactivity scale, peer problems scale and prosocial scale. Teachers did not provide comments about the children, but some parents did.

Having described the research design, including data gathering descriptions and justifications, the next section focuses on the research participants and the processes used to gather the data. The details in the next section give other researchers the opportunity to replicate this research.

3.4 Methods and Tools of the Research

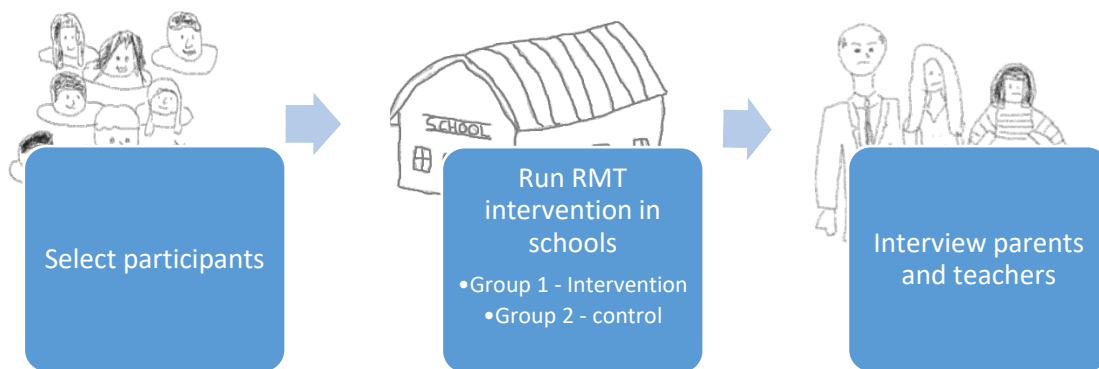


Figure 3.6. Research process overview.

This section explains the methods used to gain further understanding about the influences that RMT has on student achievement and behavioural outcomes when used in a classroom. During this research, the researcher facilitated the use of the RMT programme as an intervention, with six classes in three schools. Figure 3.6 shows the basic flow of the research: from selecting the participants, to running the intervention and then interviewing parents and teachers. Further details of the tools used to carry out the research: from ethics approval, participant selection, data analysis to ethical considerations, are detailed in Figure 3.7. Selection processes were followed before data collection commenced. Data gathering began in February of 2017 and ceased in December 2017 – one school year in New Zealand.

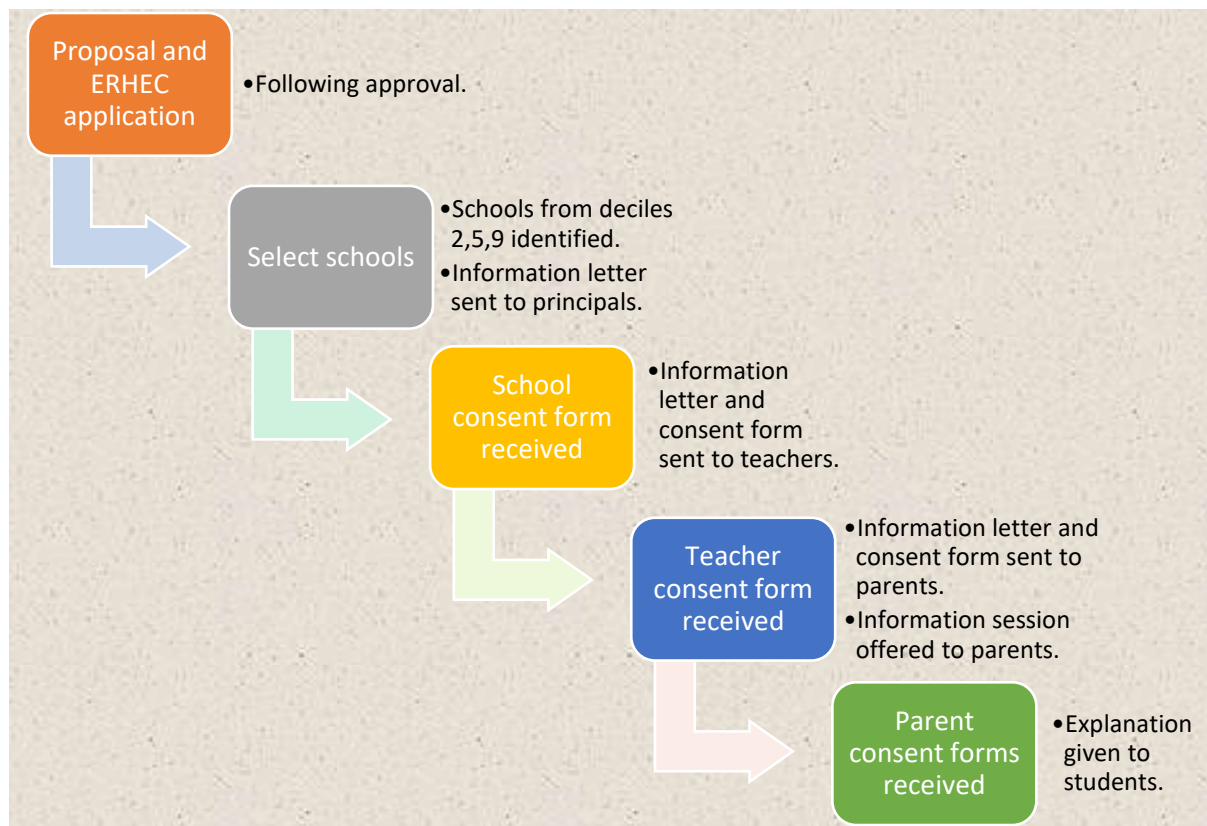


Figure 3.7. Processes used pre-data collection.

3.4.1 Participant Selection

Figure 3.7 details the processes followed for participant selection. These steps were followed in the order listed, with each step being completed before the next step began. Once ethics approval was gained, possible schools were identified from the Ministry of Education's list of schools. At the commencement of this research, New Zealand had a system of rating schools based on the value of the houses in the area zoned for the school. This meant that schools in areas with high property values were given a high decile rating, nine or ten, whereas schools in areas where the property values were low were given a low decile rating, one, two or three. School funding was then matched to the decile rating, and schools with a higher decile rating received less funding, and schools with a lower decile rating received higher levels of funding to manage the greater needs of their community. This rating system has been recently discontinued, but the schools in this research were chosen on their decile rating that was still in place at the time of selection.

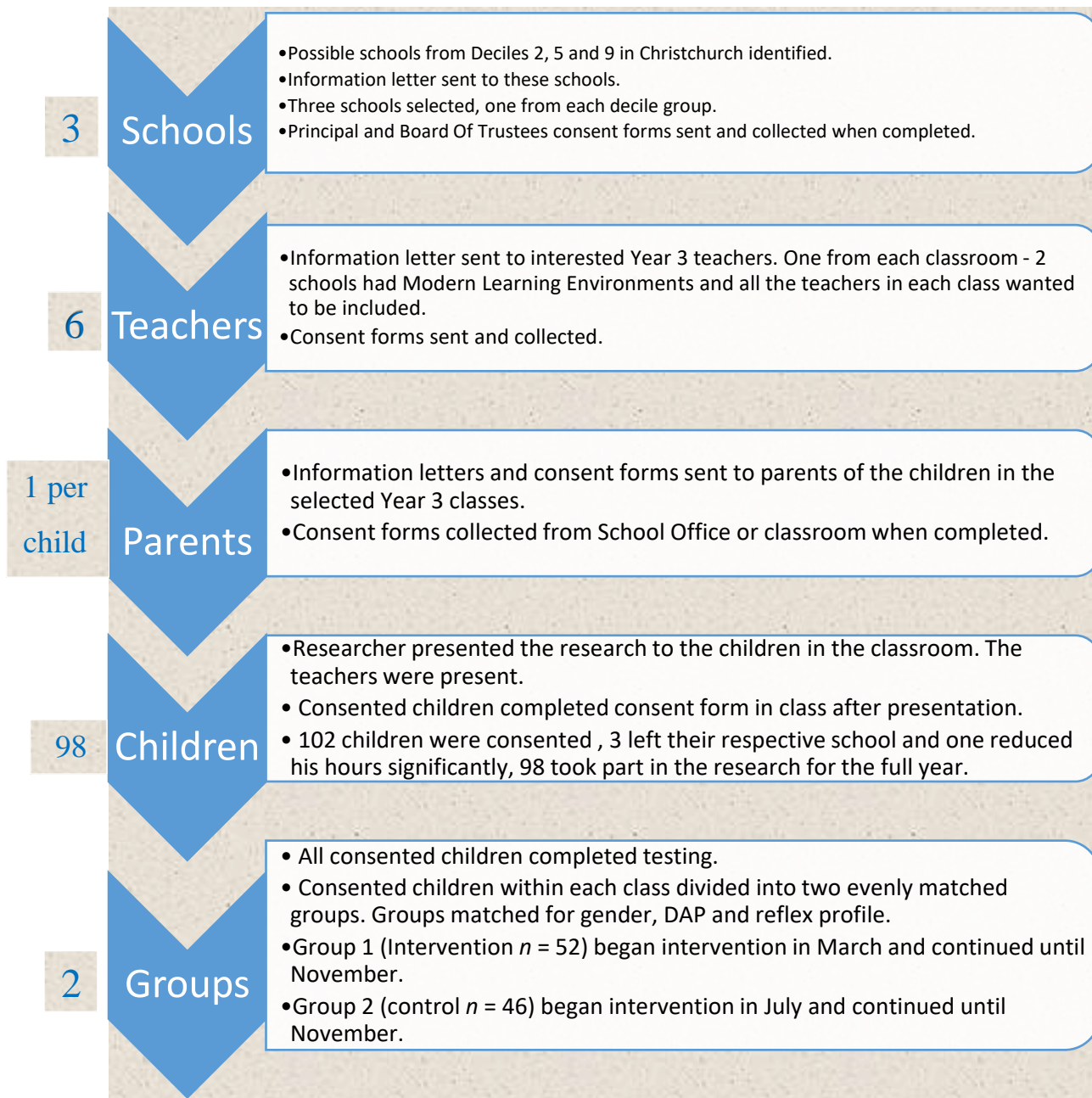


Figure 3.8. Participant selection.

Low socio-economic status (SES) has been the focus of previous studies (Brown, 2010; McPhillips & Jordan-Black, 2007a; Taylor et al., 2004) relating to retained primitive reflexes. Using the hermeneutic circles and an interpretive approach, having a range of background of children was seen to increase the possibilities for rich data and provide additional interpretative opportunities. Having participants from across a range of SES backgrounds is another point of

difference in this research to that of others (Brown, 2010; McPhillips & Jordan-Black, 2007a; Taylor et al., 2004).

Approaching schools was undertaken using information gathered from the publically available New Zealand Ministry of Education school list (Education Counts, 2017). All of the schools were in Canterbury urban areas and were all NZ government-run schools with mixed ability classes. The urban schools were chosen because the research was not comparing the skills of rural and urban children, and the researcher did not want an additional variable to consider. Canterbury has a population of 539,434 (Stats NZ, 2013) and was the second largest of New Zealand's 16 regions with 12.7% of New Zealand's population living in Canterbury. Ninety percent of Cantabrians lived in urban areas or towns with populations over 4,000. This area provided a potentially useful group to draw a sample from and was considered large enough to maintain anonymity and confidentiality. The use of mainstream mixed-ability classes provided a range of participants. For example, children with two working parents, single parents, non-New Zealand European families and families with more than one child were included. This ensured that the 'parent voice' included a range of families, both economic and cultural (Klingner & Boardman, 2011). All three schools had children with identified 'special needs' and these children were mainstreamed in the selected classrooms, often with additional support staff to meet their identified needs. Three schools with a decile rating of 9 or 10 were approached and information letters were sent (Appendices A and B). Two schools declined to be part of the research, one due to inexperienced teachers in a new team, and the other because of a building project that was already adding additional stress to staff. The third school, decile 9, was approached through a known contact and consent from the principal and teacher were gained (Appendices E and F). A decile 5 school was approached through a known contact who had expressed an interest in the research. Information was sent and consent was granted. A decile 1 school was approached and declined because of a major building project and relocation of the school. A decile 2 school was approached, information sent and consent granted. The principal chose an experienced teacher in a Year 3 class. This teacher was willing to be part of the research but return of parent consents was slow, and the principal suggested another group who were also interested. The New Zealand Ministry of Education (n.d.) has adopted Innovative Learning Environments (ILE) within schools and this means there are clusters of teachers

working collaboratively with larger groups of children in shared spaces. In the planning of the research it was intended to have three teachers in three schools, however, when teachers in a 69-child class (3 teachers), and a 40-child class (2 teachers) indicated interest in the research it was decided to allow them to be included.

A teacher from an additional school where RMT had been used for over 18 months was also interviewed. The teacher had been working collaboratively with the researcher and together they had developed the RMT programme with known children. The knowledge gained through this process informed the programme used in the three schools described below. Consent was gained from the school and the teacher to conduct an interview about the process of introducing RMT and the general perceptions of the progress made by the children. The children in this class were five years of age and did not match the age-range chosen for this research.

The schools were given pseudonyms for ease of identification and there were no schools in New Zealand with these names. The decile 9 school was called Nikau School, the decile 5 school was called Kauri School and the decile 2 school was called Pōhutukawa School. These names are drawn from the native trees in New Zealand, and a tree is often used as a symbol in education and learning.

The schools chosen to be part of the research had similarities and differences described below. At Kauri School (decile five) there were three teachers and a 69-child class. Pōhutukawa School (decile two) had two teachers in their 40-child class and the decile 9 school, Nikau School was a single teacher classroom with 26 students. This meant that of the 102 consented children 74.51% of them were in ILEs, although this research does not compare learning environments. In all three schools the teachers, selected by the principals, were experienced teachers with more than five years of teaching experience. Initially, all six teachers were female, but at the end of Term 1, one teacher was replaced with a male teacher. As is common in most classrooms, all three schools had adjusted their classroom programmes for the year based on experience from previous years, and to meet current student needs. The Nikau School teacher was using a new phonics programme and trialled the use of animals to encourage language and speech in some children. Kauri School teachers were using the Sunshine Circles programme (Theraplay Institute,

2017) to increase socialisation skills and Pōhutukawa School teachers had established ‘inquiry-based learning’, with an emphasis on project-based work.

For this research, the participant children were aged between six and nine years. This was an age in New Zealand when formal testing is used to assess stages of academic achievement. At the beginning of the research, the children were all in a Year 2 - Year 4 class although most of the children were Year 3. At the beginning of the research Year 3 teachers were targeted, but the classrooms at Pōhutukawa and Kauri had composite classes with most children in Year 3, and a few in Year 2 or Year 4. As the research questions asked about changes for students, it was decided this age range would still be able to supply useful data. Most children had been at school for at least two years, therefore removing newness as a possible limiting factor in the results. Several purposes were identified for limiting the age of the children from six to nine-year-olds. It was anticipated that children in this age range:

- can manage the movements
- can follow the instructions
- are familiar with schooling
- have reliable testing available
- receive school reports that parents could use to support comments made about their child’s development

Also, of consideration is that previous research focusing on reflex integration programmes have used children within this age range (Brown, 2010; Goddard-Blythe, 2012; McPhillips & Sheehy, 2004).

The consent process in the research involved several steps. Once consent from principals and the Year 2-4 teachers involved in the research was gained, information letters and consent forms were sent via email to parents in the associated classrooms (Appendices C and G) via the school communication systems, and photocopies sent home with children. Consent form returns were slow. One parent commented that there was so much information at the beginning of the year that needed reading and sorting. Parents also did not seem clear about what they were consenting to and this may have been a result of the University’s content requirements for information letters. It was not obvious to parents that the teacher had decided to use the movements as part of

the class routine, and that consent only related to the children's data being gathered. A simplified information letter was drafted, ERHEC approval gained and then sent out, attached to the initial letters (Appendix Ca). The response rate improved. Other techniques that improved response rates were named reminders from teachers and a personal approach from the researcher. One parent declined because of custody issues, and another parent said that she had not consented because she thought her daughter, with special needs, would hinder the results. When it was explained that the focus of the research was the rate of change in development, she agreed to give consent. During this phase of participant selection, all schools and classes were offered information sessions where the researcher was available to talk with parents or teachers and answer questions about the research. All teachers spent time with the researcher asking questions. One to two parents from each school came to these information sessions.

Child participation consent rates from parents posed some issues that needed consideration. Response rates in the decile 9 school were $n = 22$ (84.62%) students from a possible $n = 26$, from the decile 5 school $n = 50$ (72.46%) from a possible $n = 69$ and from the decile 2 school, it was $n = 8$ (32%) students from a possible $n = 25$. As the percentage of return in the decile 2 school was considered too low to be a useful sample, the school offered to change classrooms and teachers. Information and consent forms were sent to the new parents. In the second classroom, a Year 2 – 4 composite class, from a possible $n = 40$ students, $n = 26$ (65.00%) were consented. The total number of participants was $n = 102$. However, three children moved from their school, and one child reduced his hours significantly during the year making their datasets incomplete leaving a total of 98.

Figure 3.9 shows the percentage of children in each decile group. The participants in the research are compared to the general population of New Zealand primary school children (Education Counts, 2017). The graph shows that while the spread of the participants is: low decile at 25%, middle decile 50% and high decile 25%, the general NZ population is spread is: low decile 25.24%, middle decile 35.53% and high decile 39.23 %.

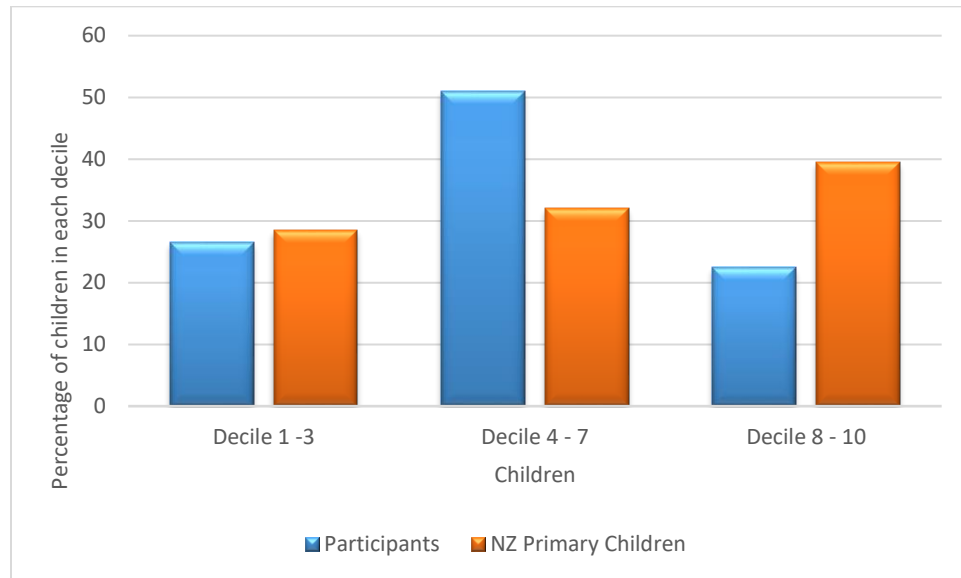


Figure 3.9. SES distribution of participants compared to general NZ population of primary school-aged children.

Note. Retrieved from <http://www.educationcounts.govt.nz/data-services/directories/list-of-nz-schools> Copyright 2017 by Ministry of Education, NZ. Reprinted with permission.

Table 3.7 (Education Counts, 2017) shows the number of participants in each decile group, and the number of children in New Zealand primary schools in the same decile.

Table 3.7. Comparison of Research Participant SES with General NZ Primary School Population in 2017

Group	Decile 1 to 3	Decile 4 to 7	Decile 8 to 10	Total
NZ Primary Children	129,646	182,515	201,496	513,657
RMT Research participants	26	50	22	98
Total	129,672	182,565	201,518	513,755

Note. Retrieved from <http://www.educationcounts.govt.nz/data-services/directories/list-of-nz-schools> Copyright 2017 by Ministry of Education, NZ. Reprinted with permission.

Table 3.8 (Education Counts, 2017) shows what the SES grouping would be if it matched the population for SES, low decile $n = 24.7$, middle decile $n = 34.8$ and high decile $n = 38.3$.

Statistical analysis of these figures was performed using a chi-squared test (χ^2). This test

assesses sampling distribution when a null hypothesis is true. The test showed that $\chi^2 = 13.7272$ and $p = 0.0010$. This indicates that the data does not completely represent the New Zealand population in relation to SES, with higher numbers in decile 4 -7 and lower numbers in decile 8 – 10 although the numbers in decile 1 -3 were comparative.

Table 3.8. *Expected Number of Participants if Participant SES was Matched to the NZ Primary School Population in 2017*

Expected to match population	Decile 1 to 3	Decile 4 to 7	Decile 8 to 10	Total
NZ Primary Children	129,657	182,530	201,480	513,667
RMT Research (the totals that would match the primary school population)	24.73996	34.83136	38.44738	98
Total	129,672	182,565	201,518	513,755

Note. Retrieved from <http://www.educationcounts.govt.nz/data-services/directories/list-of-nz-schools>. Copyright 2017 by Ministry of Education, NZ. Reprinted with permission.

As low SES has been indicated as a factor in primitive reflex retention (Callcott, 2012; McPhillips & Sheehy, 2004) the participant group does not have an over-representation of low SES children. The implication from Callcott, McPhillips and Sheehy’s research is that middle to high income groups have lower rates of retained reflexes. When the two groups are combined ($n = 72$) it compares to the $n = 73.27$ that is the expected match to the New Zealand primary school population in 2017. This then implies that the sample in this research could be viewed as a representative sample of the general population.

Following the return of parent consent forms, the children were asked for their consent. The researcher made a visit to each class, explained to the children about the research (Appendix D) and then asked them if they were willing to give their consent (Appendix H). The Educational Research Human Ethics Committee (ERHEC) did not consider this an essential requirement, but as is explained below, this researcher believes along with others (Dockett, Einarsdóttir, & Perry,

2012; Harcourt & Conroy, 2005; Mortari & Harcourt, 2012; Neill, 2005) that children have a right to be consulted and given an age-appropriate explanation about research they are involved in. It was explained to them that their parents had said it was OK for them to participate. All children willingly signed consent forms although having to have a signature was stressful for some. The signing of the forms provided a useful learning opportunity.

Participant requirements. This section describes the requirements of participants and range of data gathered before the intervention started, the mid-point and post-intervention. Figure 3.10 lists the commitments from teachers, parents and students. The teacher commitment was based on testing normally completed within their classrooms, the Strengths and Difficulties Questionnaire was the only additional test they were required to complete. They were also required to implement five minutes of RMT in their classroom each day. Reflex tests and DAP tests were organised and completed by the researcher. Parent commitment focused on the SDQ questionnaire and an invitation to a 10 – 15-minute interview. The children completed normal school-based testing, as well as the reflex tests and DAP tests and they completed five minutes of RMT each day.

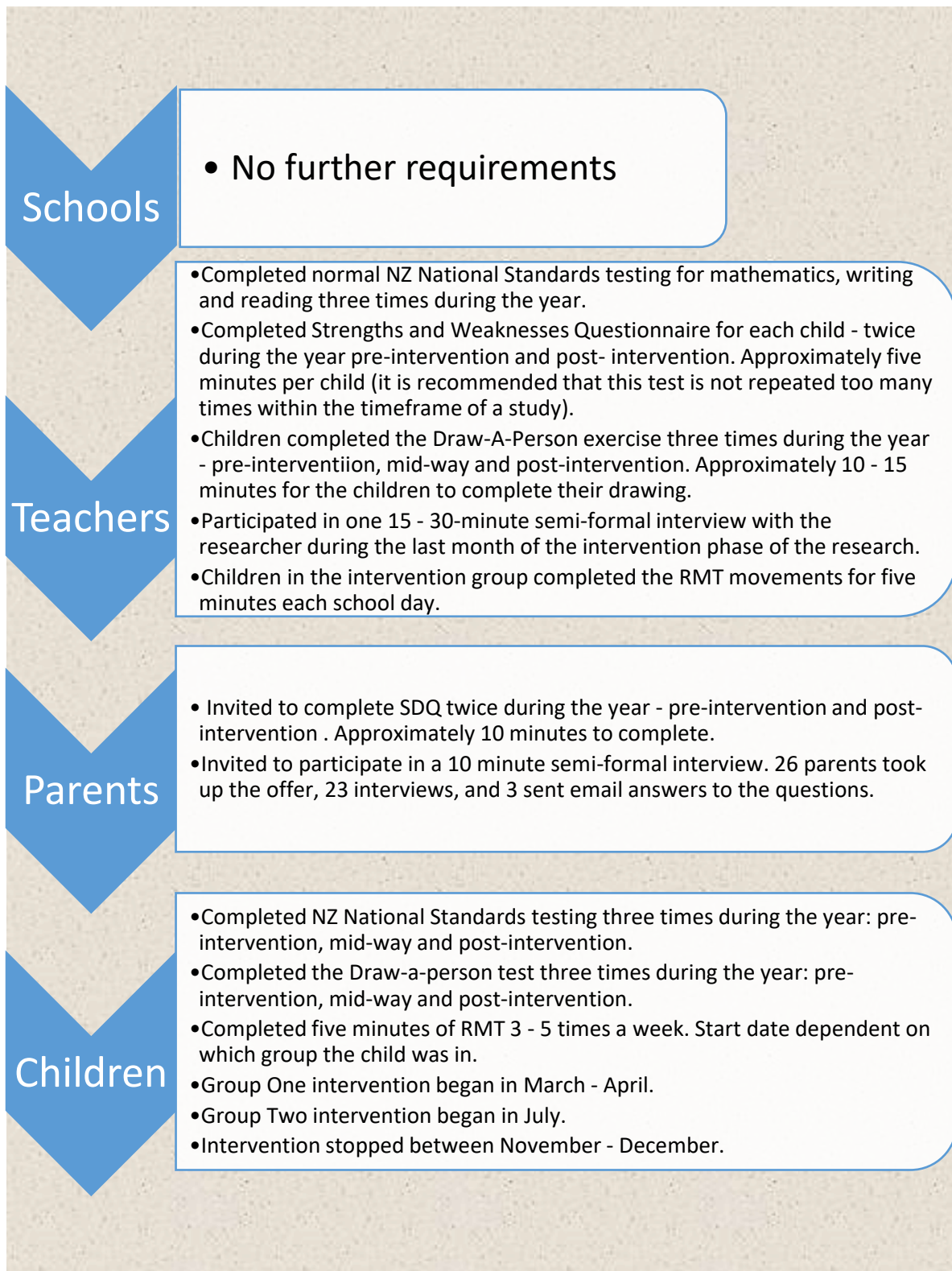


Figure 3.10. Participant requirements during the research.

School Visits. All three schools were visited on a regular basis throughout the data-gathering phase. Security clearance was gained through the University of Canterbury (UC) and included police vetting. A UC identity card attached to a security clearance lanyard was worn by the researcher during all school visits. The researcher followed the sign-in/sign-out procedures of each school for every visit. A Health and Safety plan was developed prior to the visits (Appendix W) and the researcher was mindful of safety throughout the research. During the collection phase, no Health or Safety issues arose.

Teacher commitment throughout the research was a constant consideration. To compensate for the time teachers needed to spend gathering data for the research, all schools were offered four hours of music teaching per classroom throughout the year. The researcher took these sessions. Nikau and Kauri took up four hours for each classroom and Pōhutukawa used one hour. Music, drama and dance sessions were provided for the children and two teachers used part of the time to complete the SDQ. Otherwise, they were free to use the time to test children or complete administration. At Pōhutukawa the researcher helped with group projects while the teacher completed the SDQ. At the completion of the research, all teachers were given two movie vouchers each as a token of appreciation for time spent taking part in the research.

Formation of groups. The participants in the research were divided into two groups – control and intervention. Group formation in quantitative research is seen as pivotal in issues of reliability and credibility. The common method in quasi-experimental research is to use two classrooms, matching for age, academic range, socio-economic status and experience of teachers. The criticism associated with this method of group selection is that the results can be linked to the effectiveness of the teacher. To address this issue, each classroom was divided into two evenly matched groups, based on gender, reflex test scores and neurological age (DAP test). The two groups within each classroom were then randomly assigned as group 1 – intervention or group 2 – control. The exception to this was Kauri School. With three classes within their ILE, the teachers decided from a management perspective it would be easier to have one whole class in group 1, another whole class in group 2 and the third class randomly divided based on gender, reflex tests and neurological age. When the whole group of participants at Kauri were analysed,

the two groups were still evenly matched. All the children were taught by all teachers within the ILE.

3.4.2 Intervention: Rhythmic Movement Training:

The intervention for this research was the Rhythmic Movement Training programme implemented in the participant classrooms with participating students. The programme targets retained primitive reflexes in the child that have not integrated normally as described in Sections 1.2.1 and 1.2.2. The movements were easy for children and teachers to learn, they did not require the use of any equipment and once learned, the children could choose which movement they preferred to complete. They could change their movement daily or repeat the same movement each day. This element of choice for children is an important aspect of the programme. It fits well with student-centred models of teaching (Martell, 2015) and the movements are not compromised by the student having control of what they perform. The teachers also had some control over which movements were completed. They were able to have days when there was a free choice and other days when the teacher chose the movements. This enabled the teachers to ensure that children did not completely avoid a particular movement, but the children could focus on movements they liked. Teachers were encouraged to use the movements daily for approximately 5 minutes in total. This aligns with distributed practise theory (Donovan & Radosovich, 1999) for skill development: small amounts of practice, often. However, it is noted that only four of a possible 17 movements were used. This was to minimise teacher loading of new information for the research process. Another point to note is that progressions can be made when children are using individualised programmes; they learn a movement and then visual skills may be added. In this research, no progressions were made, to ensure that replicability was possible. The four movements were chosen, and these were completed by the children for the duration of the research.

Teachers were given training by the researcher, so they could ensure that children completed the movements accurately. However, to minimise their pre-conceived ideas or bias as to the possible outcomes, minimal information was given about reflexes and the range of challenges associated with retained reflexes. They understood that the RMT movements were designed to help

development, but none of them read extensively on the subject or completed more detailed training. This added to the rigour of the process as described further in section 3.2.3.

The four movements chosen are described below. Sliding on the back, bottom/hip rolling, windscreen wipers and STNR knee rock movements were taught in the first four weeks, one movement each week. All these movements have a passive and an active version which allows for teacher assistance if needed. When the students had learned the four movements, they were able to choose the movement or movements they would prefer to complete each day. Children could decide to complete the movements at home during the weekend as the difference between five and seven sessions per week was not expected to change the outcomes notably.

These movements were chosen as they related to the reflexes tested. However, they also related to other reflexes, giving them a generic nature (Blomberg & Dempsey, 2011). After four months, group 1 (intervention group) was taught one additional movement: chest thumping. Group 2 (control group) learned the four original movements as well as the last one. The researcher taught the movements over several weeks, although the control group learned them very quickly as they could observe the intervention group during the teaching sessions.

The movements were taught to the six teachers by the researcher. Permission from Moira Dempsey (Rhythmic Movement Training International organisation) was gained (Appendix Za) to teach the teachers the specified movements. The researcher is a registered practitioner with experience in the use of the movements and classrooms were monitored through weekly visits for the first four weeks, checking that the movements were being performed correctly and to answer any arising questions. Williams (2015) found that completing movements daily improved academic outcomes. This research adds to the information she found. The movements are described below. All movements had a passive option, where an adult could make the movement. This was viewed as useful for children with special needs and meant that they could participate in the activity. It was also useful to have a passive option so that a struggling child, could be helped. For all the movements it is preferable that the child sets the speed of the rhythm.

Windscreen Wipers: Children lie flat on the ground with their backs on the ground, legs stretched out. The feet are together. They are asked to move their feet in a windscreen wiper

fashion, both in and then both out. They are encouraged to involve the whole leg, and to check they are doing that, they put their hands on their hip bones and they should feel movement. Children are checked to make sure they are moving their legs evenly and rhythmically.

Hip/Bottom Rolling: Children lie on their fronts, stretched out. They are asked to move their hips from side to side. The feet and shoulders need to remain still. To achieve this the movement will be very small. Children are checked for evenness of movement and stillness of feet and shoulders. The movement should be rhythmically even.



Figure 3.11. STNR

Rock starting position.

STNR Rock: Children kneel and sit back, (Figure 3.11), hands are placed on the ground in front. Children make a rocking action, similar to the backwards and forwards rocking action a pre-crawling child makes. Children are checked for feet flat on the ground, hands flat on the ground and even rocking. The rocking needs to be rhythmically even.

Sliding on the back: Children lie on their backs, knees bent. Using their legs and feet, they make small sliding movements. The movement is small and essentially they are moving backwards and forwards inside their skin. The head needs to nod, and the fingers will move up and down a little when the movement is fluid and the rocking is rhythmically even. This is the most challenging of the movements and is best taught after the first three are established.

Chest Thumping: The child uses the flat part of the knuckles to tap the chest, on the sternum at the level of the second and third ribs. Similar to a gorilla thumping its chest.

Pictorial representations and further descriptions of the movements are in Appendices P and Q.

3.4.3 Qualitative Data Gathering

Qualitative data-gathering took place throughout the research. Field notes were made, and a research diary was kept, but this section details the considerations around interviewing and

analysing the data gathered. As has been discussed in Section 3.2, the spoken word is paramount in hermeneutic phenomenology and the careful management of data is described in this section. The interviewing process, along with the keeping of field notes and a research diary are described first, followed by measures to keep the data reliable and safe (Figure 3.12). Finally, there is a description of the data analysis process undertaken in this research.

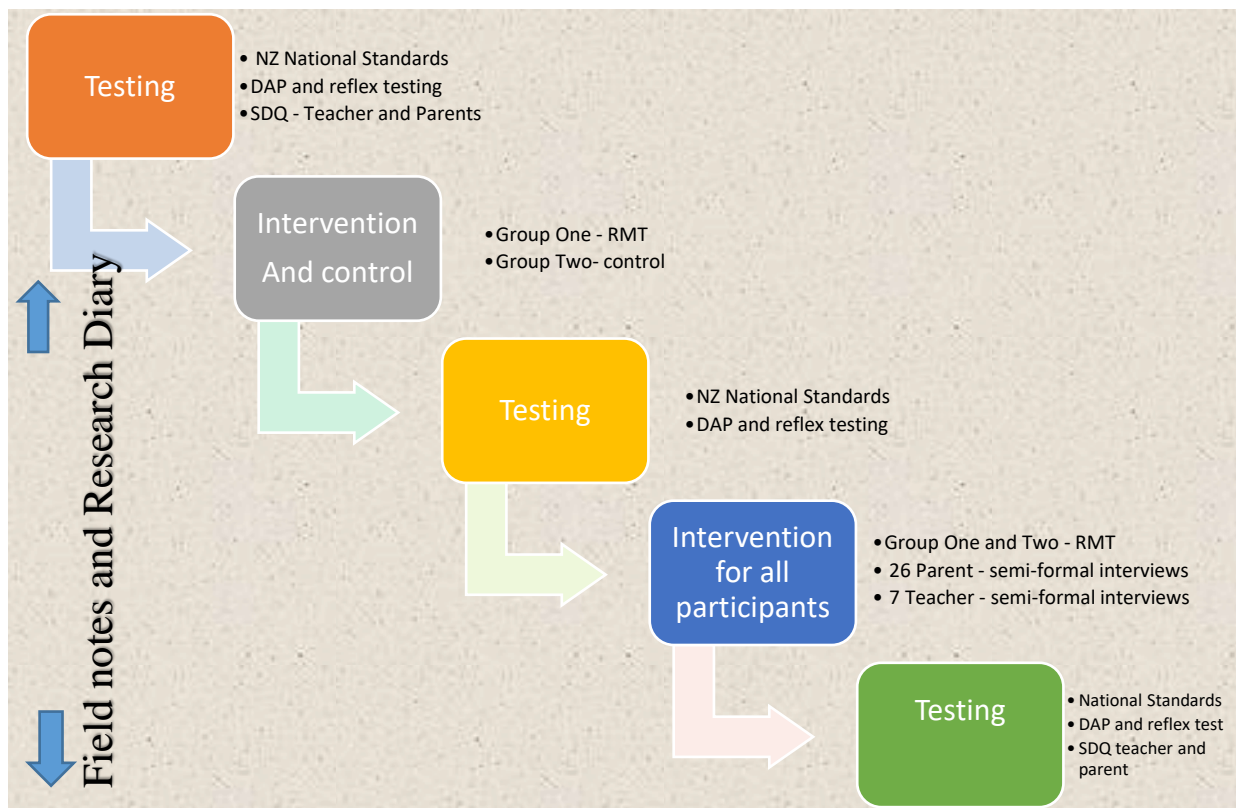


Figure 3.12. Data gathering overview.

Semi-formal interviews. In this research, qualitative data was gathered through semi-formal interviews with teachers and parents. As described in Section 3.1, hermeneutic phenomenology places importance on the lived experience of the participants in relation to a phenomenon, in this case, RMT (Friesen, Henriksson, & Saevi, 2012). Henriksson (2012) describes hermeneutic phenomenology as the “missing link between theory and practise” (p. 134). RMT appears to be an easy set of movements to include in a daily routine, but is that the ‘lived experience’ of the teachers who have been part of the research programme? The interview process and the field notes attempt to capture that information. Approximately 15 minutes was advertised and allocated for the interviews with parents although some lasted longer than this.

There was no time limit for teachers, although 15 to 30 minutes was suggested in the information provided.

The structure of the written/spoken data analysis is central to hermeneutic phenomenology. Gadamer (1975b) places importance on the conversation that takes place between people, with the translation and interpretation of the language used in the conversation determining the level of understanding gained. It is suggested by Finlay (2012) that the interview data is analysed in a spiral, first the researcher focuses on the story, with an importance placed on the language used as the participant recounts their perceptions of the phenomenon: RMT and the child's development. Then the common themes are established through an analysis process which investigates the essence of what the participant has offered. Finally, the researcher needs to go beyond the obvious and essentially read between the lines. This stage offers the meaning of the 'lived experience' that has been reflected on. Finlay (2012) emphasises the importance of moving between the experience and the themes to create an 'uncertainty' and thus offer an interpretation of the 'lived experience'.

Figure 3.12 gives a summary of the process for the data gathering used in this research. In the initial research planning, focus-group interviews were prepared for parents (Appendix I). In line with concerns raised by ERHEC, and as the research progressed, discussions with colleagues highlighted that fact that semi-formal individual interviews with parents would be more appropriate. The ability to maintain confidentiality was higher, and emotional safety of the parents was more able to be maintained. The questions were not changed, just the method of collecting the data. All parents with children consented in the research were invited to attend an interview. Along with the invitation to participate, the interview questions were sent. A booking system for interviews was used through the online appointment system Acuity (Acuity Scheduling, 2017). It was anticipated that 24 parents would be randomly selected to be interviewed. Twenty-six parents replied and either booked an interview time or sent an email response to the questions. This meant that the interviewees were self-selected. Twenty-two face-to-face interviews were completed, two telephone interviews and two email responses were received. The interviews were recorded for transcription purposes only, and participants were made aware of this. The questions asked in the parent interview by the researcher were about

aspects of the child's development while they were participating in the RMT programme and an additional question about the child's birth, with reference made to the delivery in relation to the Canterbury earthquakes of September 2010 and February 2011 (Appendix I). All parents willingly answered all questions. Eighteen mothers and six fathers were interviewed lasting between 5.05 and 15.49 minutes.

Following each interview, field notes, as described in Section 3.2, were written with perceptions and observations recorded by the researcher. The recorded interviews were transcribed, word-for-word by the researcher. Transcriptions were emailed to parents to ensure that an accurate record had been produced. An explanation of the normal way transcribed speech appears with all the disfluencies such as umms, and repetitions of words, was given and parents were assured that all identifying words and comments, e.g. street names, professions, and medical history would be removed if quoted. They were also asked to reply to the researcher if there was any aspect of the interview they would prefer was not quoted. Two parents sent replies that affirmed the transcripts. No other comments were received, and no parents asked that information be withheld from being quoted. This process of member checking transcribed data is part of the rigour and trustworthiness described below and as recommended by Creswell (2013).

It was suggested that parents could bring reports from educational and health professionals involved with the child if they wished to support the comments made. For example, parents may have wanted to use school reports or occupational therapy reports to support their description of their child and the issues they have experienced. However, professionals were not approached independently by the researcher. One parent supplied a report from a child psychologist to support her comments.

Following the interviews all data, both written and verbal, were transcribed by the researcher. This was viewed as an important aspect of the data analysis and enabled the researcher to be very familiar with the material. All interviews were checked twice to ensure the accuracy of transcribing. All words were transcribed, including disfluencies such as: umms, word repetitions and gap fillers. To enhance understanding and readability, disfluencies have been removed from quoted material in this thesis. Care was taken to maintain the normal speech patterns of the interviewee and the meaning they were conveying.

Teacher Interviews. Semi-structured interviews were conducted with each teacher in the 10th month of the research. The teacher's perceptions relating to the use of the programme in the classroom and the general impressions the teacher has about perceived changes in the children within the class were discussed (Appendix J). The teacher interviews lasted between five and 18 minutes. Having made multiple visits to the school throughout the year, the interviews became a summary of what had happened. These interviews were conducted in December, at the end of the school year. All teacher interviews were recorded and transcribed. Copies of the transcripts were sent to the teachers and they were invited to comment. Similar information given to parents about the structure of transcribed spoken speech and the removal of identifiers was given to teachers. They were also given the opportunity to withhold information from quotes. There were no comments from teachers and no information was withheld. This process of providing interviewees with their transcripts was also part of ensuring trustworthiness of the data. This data was put alongside journal notes that were made after each visit to the school. After each visit, the researcher made comments about the movements or changes noticed.

3.4.4 Qualitative Data Analysis

The qualitative data analysis process used in this research used a layered process. As is suggested by several authors (Bogdan & Biklen, 2007; Coffey & Atkinson, 1996), a coding system was used on the analytical memos and the transcribed parent and teacher semi-formal interviews to gather themes. Codes or Nodes as NVivo 11 (QRS International, 2015) describes them, were given to categories which enabled the describing and classifying of data. This process facilitated the interpretation of the data so that meaningful themes could be commented on. The data was evaluated several times in a spiral manner, with broad themes being identified initially and then those themes classified to a greater depth into sub-themes (Creswell, 2013). Interpreting the data involved looking beyond the themes to the greater meaning of the data and its links to the research literature of others. The data is presented in written report format. This section details the coding process.

Transcription and Coding with NVivo 11. Following the collection of data from parents and teachers, the analysis was carried out in the following manner: field notes were written, and all interviews were transcribed by the researcher with transcriptions checked twice to ensure accuracy. Gadamer (1975b) views this level of detail as an essential part of the hermeneutic conversation which attempts to gain a greater understanding of the meaning of the language used by the participants. Parents and teachers were then emailed a copy of the completed transcription and it was noted that it was possible that some comments would be quoted in the final thesis. The participants were invited to comment or request to withhold parts of their interview from being quoted. The data analysis was completed using NVivo 11 software (QRS International, 2015). Nodes were allocated initially and then added to as the process progressed (Table 3.9), and comments were coded to each related node. Some comments were coded to more than one node. This process of coding was reviewed three times, checking that comments were coded to the correct nodes. Additional nodes were added on the second review. Reading the transcripts multiple times as part of the analysis is consistent with the hermeneutic phenomenological process described in Section 3.1 where data is reviewed to deeper levels as meaning from the ‘lived experiences’ is uncovered (Lindseth & Norberg, 2004).

Table 3.9. *NVivo 11 Nodes Used for Coding*

	Nodes			
1	Age when quake struck		9	Positive reading comments
2	Birth comments		10	RMT in the classroom
3	Developmental changes		11	Social – Teacher
4	Earthquake general		12	Social changes
5	Earthquake/Birth comments		13	Social relationships
6	Exercises (RMT) comments		14	Sport comments
7	Expected change comments		15	Tricky Year
8	Good year		16	Unexpected change comments

Three themes emerged from the coded material. The themes related to the classroom, student achievement and student behaviour as shown in Figure 3.13. Within the ‘RMT in the classroom’ theme, comments from participants relating to the Canterbury Earthquakes were placed as this was part of their ‘lived experience’. The comments about the use of RMT in the classroom and

the student engagement were within this theme. The ‘Perceptions of student achievement’ had comments from both parent and teachers relating to academic and sporting progress, and in the ‘Perceptions of student behaviour’ theme comments relating to behaviour and socialisation were placed. The findings in relation to these themes are discussed in Chapters 4 - 5.

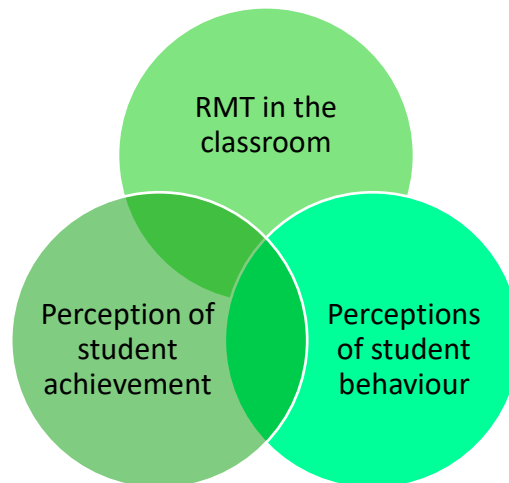


Figure 3.13. Theme structure.

3.4.5 Quantitative Data Gathering

The quantitative data in this research was based on achievement of students and reflex retention. The results from the testing used in New Zealand schools (Ministry of Education, 2011) for the purpose of NZ National Standards assessment in reading, writing and mathematics were used pre- and post-intervention, as well as at the mid-point when the control group began the movements. This provided three data-gathering points over the 10 months of the research. The tests have been described in Section 3.3. Table 3.10 gives an overview of the data collection and the associated time points. It also shows the intervention time points for each group.

Table 3.10. *Data Collection Timeline*

Date	Testing/data gathering	Who	Group 1 intervention	Group 2 control
2017 Feb	NZ National standards-reading, writing, mathematics	Teacher	No intervention	No intervention
	Draw-A-Picture	Teacher/Researcher		
	Reflex testing	Researcher in classroom		
	SDQ – paper or online	Parents and teacher		
	Two evenly matched groups formulated	Researcher		
2017 Mar – Jun	No testing – Phase 1		RMT started	Normal Programme
			1 movement added each week	
2017 Jun	NZ National standards-reading, writing, mathematics	Teacher	RMT continues for Group 1	RMT begins with Group 2
	Draw-A-Picture	Teacher/Researcher		
	Reflex testing	Researcher in classroom		
2017 Jul-Dec	No testing – Phase 2		1 new movement added	4 movements plus new movement added.
2017 Nov	Semi-formal Interview	Parents		
	Semi-formal interview	Teacher		
2017 Late Nov/Dec	NZ National standards-reading, writing, mathematics	Teacher	RMT stopped at the end of November	RMT stopped at the end of November
	Draw-A-Picture	Teacher/Researcher		
	Reflex testing	Researcher in classroom		
	SDQ – paper or online	Parents and teacher		

Reflex tests. Reflex testing was completed three times during the 10 months of the research: pre-intervention, mid-way and post-intervention. The tests were completed in the classroom with the teacher present but engaged in other activities. The three tests have been outlined in Section 3.3. They are simple individually-administered tests, which take approximately five minutes to complete for each child. All tests were video-recorded to check for reliability of testing. On completion of the testing, the researcher viewed all video material to check that the score given matched what was seen on the screen. Minor adjustments to the scoring were made, usually under-reporting initially, but most of the 909 tests were considered an accurate assessment of the presence or absence of the reflex. Video recordings of 45 tests in the first round of testing were sent to Australia to be moderated by an experienced reflex tester, Dempsey (Blomberg & Dempsey, 2011). Dempsey has had over 10 years of experience using reflex tests with children and is one of the developers of the RMT programme. She viewed all 45 tests and gave a score for each test. When the tests were returned there was disagreement with three of the 45 tests: in two tests the reflexes were under-reported and in one test the reflex was over-reported, or 6.67% disagreement and 93.33% agreement.

Children's drawings: Draw-A-Person. The Draw-A-Person (DAP) test has been used in similar studies (Erasmus et al., 2016; Williams, 2015) as a way of measuring neurological changes. The children drew a picture of themselves pre-intervention, mid-intervention and post-intervention (Porteous, 1996) as described in Section 3.3. The drawings were given a score to measure developmental changes, but qualitative information was also gathered from this exercise to triangulate quantitative data. The tests were performed in the classroom setting and children could see other children's drawings although they were encouraged to focus on their own work. Pre-printed, numbered A4 sheets of paper were given to each child and they were instructed to use a pen or pencil for their drawing. They were asked not to colour the drawing. They were instructed to draw the best drawing they could of themselves, from head to toe. They were not given reminders about body parts that they may have missed, and they were not sent back to add missing parts. All children took between two and 20 minutes to do their drawings. A time limit was not set as it was felt that this was an unnecessary pressure to put on the children.

Once the drawings were completed the names were removed. This meant that only the Student ID number was visible to the researcher as the scoring was completed. This ensured that the scores had a high level of trustworthiness because the person scoring could not be swayed by the name of the child or information they may already have had on the child. The researcher was present for the tests at Nikau and Pōhutukawa, but the teachers at Kauri completed the test at times that suited their programme. With 98 drawings to score, the likelihood of remembering who drew which picture was small but to further ensure this, drawings were left for several weeks before the scoring was undertaken. A scoring sheet was used (Appendix R) and a point given for each identifiable body part on the drawing. The researcher was the only person to complete scoring thus maintaining a good level of consistency. Blind scoring was repeated for the first round to ensure the reliability of the data. Of the 98 drawings, 10 scores differed by 1 point and three differed by 2 points. At the mid-point and post-intervention, the DAP was repeated. The same process was used, and the scoring completed. Once the scores were completed they were also assessed against the visual look of the previous drawing to ensure changes were reflected in the scoring.

Strengths and Difficulties Questionnaire (SDQ). Parents were asked to complete the two-page Strengths and Difficulties Questionnaire (SDQ) (Appendix K). All children had the SDQ completed by their teacher. Parent return rate was lower. 40 parents from a possible 102 (39.22%) for the first request for the questionnaire to be completed and from a possible 98, 28 parents (28.57%) for the second request. Both teacher and parent responses were used as data in the SDQ analysis.

3.4.6 Quantitative Data Analysis

Variables. Research variables are the measurable attributes or characteristics of an organisation or individual (Creswell, 2009). The quantitative data in this research provides variables relating to the measurable achievements of the students who have used RMT (Table 3.11). The questions being asked are: does the use of RMT make changes to children's achievement and/or behavioural outcomes, and are there differences when gender, SES or reflex profiles are factored in? (Creswell & Plano Clark, 2011).

Table 3.11. *Variables Used to Answer Research Questions*

<i>Variables</i>	<i>Research Questions</i>	<i>Items used to answer the research questions</i>
<i>Independent Variables –fixed effects Or explanatory variables</i>		<i>RMT Exercise group/control group RMT Exercise frequency</i>
<i>control Variables Or Additional Explanatory Variables</i>		<i>Gender SES (groups matched for these variables)</i>
<i>Dependent Variable 1 Or Response Variable 1</i>	<i>What influence does participation in an RMT programme have on student achievement: reading, writing and mathematics?</i>	<i>Reflex Profile Reading, writing and maths tests Draw-a-person</i>
<i>Dependent Variable 2 Or Response Variable 2</i>	<i>What influence does participation in an RMT programme have on student behaviour: social and emotional?</i>	<i>SDQ questionnaire completed by parents and teachers Draw-a-person</i>

These questions in Table 3.11 were analysed statistically using two models (Figure 3.14). It is important to note here that age was not used as a control variable and the results apply to the children in the research group, not the general population. While the frequency of RMT was part of the qualitative data, it was not initially factored in as an important predictor of outcome. However, as is discussed in Chapter 5 and Section 3.2, while using exploratory data analysis, it became clear through the qualitative interview process that this aspect of the RMT programme was a statistically significant predictor. When comparing frequency as a factor, the participants were allocated a frequency level, <4/week (less than four times per week) and ≥4/week (four or more times per week). Children in the control were excluded at Time 0 as they were not using the movements and this calculation was to measure the RMT frequency effect. The next section describes the statistical model used to answer the research questions (Table 3.11).

Statistical Model – Linear Mixed-effects. When two or more variables are examined using statistics, a mathematical expression is developed to explain the relationship. This is called a statistical model and in this research R Statistical Software (R Core Team, 2018; Zuur, Ineno, Walker, Saveliev, & Smith, 2009) was used. There are a range of models used in statistics but the best fit for this study was a linear mixed-effects model (Price, 2016). Correlation measures the extent, or magnitude of the relationship between two or more variables based on estimates or predictions gained through the knowledge of one of the variables (L. Cohen et al., 2011). In this study, the dependent variables (response variables) were the range of tests used (reflex tests, DAP, academic tests and SDQ). The independent variables (explanatory variables) were: time completing RMT (accounting for the group to which the child was allocated: intervention or control) and frequency per week of the movements, with control variables such as gender and SES considered. A simple linear regression predicts the outcome of one variable and in relation to another variable (Coolican, 2014). However, as indicated above, there were several independent variables and control variables in this research. Time was a factor and individuals were tested multiple times, indicating that the linear mixed-effects model was the best fit for examination of the relationships between multiple variables.

Statistical analysis is based on assumptions being made (L. Cohen et al., 2011). The assumptions are determined by the type of test used, in this study a linear mixed-effect model, and they ensure that the results are reliable and meaningful. The assumptions include: linearity, the absence of collinearity, homoskedasticity of residuals, normality of residuals and independence. These assumptions were met for all tests through checking a scatter plot of predicted and residual values and a Q-Q plot ensuring the data fell along a straight line (Appendix U) (R Core Team, 2018; Winter, 2013).

Statistical significance indicates that chance is an unlikely explanation for the results (L. Cohen et al., 2011). For this research, statistical significance was set at < 0.05 and the reporting in Chapters 4 and 5 reflect this. The linear mixed-effects model that accounts for random effects and the multiple time points, along with a robust statistical significance level gives the results in this research increased credibility and reliability.

Two statistical models were used (Figure 3.14). *Model 1: group* was based on the interaction between the control and the intervention group as described in Section 3.4. *Model 2: Frequency* was based on the interaction between the children completing RMT four or more times each week and children completing RMT less than four times each week. The *expected* responses, differences or effect (Figure 3.14) indicate that not all children in the control group will have exactly the same response, but as an example, if 100 children were tested for reflexes and the average score calculated, the number would be close to α (alpha) in the formula. Results from both models are reported in Chapters 4 and 5.

<i>Model 1: Group</i>	<p>Is the response of a child predicted by time and group when completing the RMT intervention?</p> $Response = \alpha + \beta \times Group + \gamma \times Days + \delta \times (Days \times Group)$ <p>0 = control 1 = intervention</p>
	<p>α = Expected response for the control group at Day 0 β = Expected difference in response of the intervention vs control group at Day 0 γ = Expected effect of adding a day to the control group δ = Expected difference in the effect of adding days for intervention and control groups Group = control group or intervention group Response variables: Reflex profile, DAP scores, reading scores, writing scores, mathematics scores, SDQ scores.</p>
<i>Model 2: Frequency</i>	<p>Is the response of a child predicted by time and frequency when completing the RMT intervention?</p> $Response = \alpha + \beta \times Frequency + \gamma \times Days + \delta \times (Days \times Frequency)$ <p>0 = ≥ 4/per week 1 = < 4/ week</p>
	<p>α = Expected response for the $\geq \frac{4}{week}$ group at Day 0 β = Expected difference in response of the $< \frac{4}{week}$ and $\geq \frac{4}{week}$ groups at Day 0 γ = Expected effect of adding a day to the $\geq \frac{4}{week}$ group δ = Expected difference in the effect of adding days for $< \frac{4}{week}$ and $\geq \frac{4}{week}$ groups Frequency = ≥ 4 repetitions per week or < 4 repetitions per week Response variables: Reflex profile, DAP scores, reading scores, writing scores, mathematics scores, SDQ scores.</p>
	Both models had gender added as a control variable when reflex profile was the response variable.

Figure 3.14. Linear mixed-effect statistical model used in this research.

3.4.7 Integration: Mixed Methods, Convergent Design

The merging of qualitative and quantitative data is a strength of a mixed methods design according to Creswell and Plano-Clark (2011). The results are strengthened by the range of material provided. For this research, the qualitative data were analysed first while waiting for final quantitative academic results to arrive. This gave an indication of RMT's influence in the classroom and overall student achievement and behavioural outcomes. As discussed in Section 3.4 the qualitative data were analysed with themes emerging. Following that process, the quantitative results were woven into the qualitative themes, providing further information and insight into the explanations given by teachers and parents. The following section is further discussion regarding processes used for quantitative and qualitative data analysis.

3.4.8 Validity and Reliability, Rigour and Trustworthiness

Validity, reliability, rigour and trustworthiness are essential aspects of credible research. According to Cox and Ros (2008), time is an essential component in relation to establishing the trustworthiness of research. "Prolonged engagement" was the focus for Guba and Lincoln, with the inclusion of "persistent observation" and "peer debriefing" (1989, p. 237). Time spent building rapport with participants is valued within the research and adds to the reliability. This needs to combine with time spent discovering relevant elements and time with peers working through the processes (Guba & Lincoln, 1989). Member checks (parents and teachers were able to read transcriptions) and asking participants and supervisors to read preliminary findings, added rigour to the research. The design has considered the points highlighted in the following discussion to ensure qualitative and quantitative data reliability, validity, rigour and trustworthiness within this research. The assumptions associated with quantitative data have been discussed in Section 3.4.4.

Rigour and trustworthiness in qualitative research. Four broad areas are related to trustworthiness and rigour in qualitative research. These are credibility, transferability, dependability and confirmability (Guba & Lincoln, 1989). The processes described below aim to make decisions transparent and therefore allow for open critique and clarification from other researchers.

- *Credibility* in qualitative research refers to the ability to determine if the results are believable and/or credible (Creswell, 2013). The participant's perspective is essential in this process as they are best able to determine the credibility of the presented findings. Detailed field notes are important in determining credibility as is good quality sound recording equipment. When combined, both elements allow for accurate transcriptions to be made from interviews. Documenting as much as possible from the recordings aids the analysis process. Disfluencies, pauses and expressions add an important dimension to the transcripts so that strong feelings are captured. The focus on language is an important aspect of hermeneutical phenomenology and attention to detail in this area enhances the credibility. Reliability and credibility associated with the data are increased when adult participants are given an opportunity to read transcripts or have discussions about the findings before the research is published. Adult participants were emailed a copy of the results and discussion chapters and invited to make comments before the writing phase of the research was completed.
- *Transferability* in qualitative research and external validity in quantitative have parallels (Guba & Lincoln, 1989). External validity relates to the randomising of the sample in order to achieve generalisation of the results to a population. Transferability requires extensive descriptions of the participants, the context, place and culture in which the research was completed. However, in some situations, transferability will not be able to be achieved due to the conditions of the research, for example gathering the lived experience of one person in a case study. In this research, the use of mixed-ability classes from a range of SES areas enhanced randomisation of the participants and the clear descriptions in Sections 3.4 and 4.2 ensure that transferability of the research to another similar group would be possible.
- *Dependability* in qualitative research requires rigorous documentation of changes to the methodology and environment. It is accepted that changes may occur as the inquiry matures, and provided they are thoroughly documented, the changes can be viewed as strengths (Bogdan & Biklen, 2007). Within this research, detailed, methodical data collection facilitated documentation of changes and these have been noted above. The main change was the way the parent interviews were formatted, from focus-group interviews to individual semi-structured interviews.

- *Confirmability* is the final component of trustworthiness (Mutch, 2005). There needs to be a clear trail showing that the data collected does belong to the participants of the research and is not fabricated by the researcher. A successful audit should be able to locate copies of recorded material, transcripts with coding available, observer comments within the transcripts or field notes and a research diary. Dates (including time), places, participant names and context increase the confirmability and show the auditor a degree of order in the documentation. Interviews, being the main data collection method in the qualitative area of this research, could provide additional challenges. However, the researcher had robust systems in place. Tolich and Davidson (1999) remind researchers that participants may refuse to answer questions they consider too personal, or they may not divulge the truth. This can mean that the hermeneutical process, which relies on what is said and how it is said, may have data missing. It may be possible to assess and address the possibility of missing data in situations of extended interviews, however, this was not as easily achieved with the parents in this research due to the high number interviewed ($n = 26$). However, with multiple opportunities to interact with teachers, a greater depth of information was gathered over a longer time (11 months). Consideration also needs to be given to issues relating to power within relationships or the possible perceptions a participant may have that they need to act or behave in a certain way and it is possible that this could influence data. The challenge for the researcher is to build a positive relationship with the participants so that rich, truthful descriptives can be gathered (Tolich & Davidson, 1999). The initial questions in both teacher and parent interviews were designed to allow rapport building to take place. For example, “What are your general perceptions about your child’s year at school?” The parent was free to choose what aspect they wanted to talk about from the start of the interview. Reliable data is more likely to be gathered when researchers are mindful of such challenges.

Validity and reliability in quantitative research. A range of factors relating to validity and reliability were considered when gathering the quantitative data in this research. These are discussed below.

- *Internal validity* relates to the ability to demonstrate that data gathered from the intervention can be replicated, thus providing credible, dependable interpretations (L.

Cohen et al., 2011). Accuracy is an issue that is addressed through clear, detailed descriptions of the processes used. Descriptions of the reflex testing (Appendix S) and the DAP tests (Appendix R) have been included in this thesis. NZNS reporting was publicly available through the NZ Ministry of Education website (Te Kete Ipurangi (TKI), 2009) and written descriptions of the movements were provided to teachers and parents (Appendix P, Appendix Q). The components that ensure the research provides reliable evidence are discussed below.

- *History* requires the consideration of events other than the intervention that may occur between the pre-test and the post-test, particularly in longitudinal research such as this (L. Cohen et al., 2011). The use of other interventions as part of normal classroom activity need to be declared and accounted for in the results.
- *Maturation* relates to the changes, such as the growth of the child, that can influence the outcomes, independent of the intervention (L. Cohen et al., 2011).
- *Statistical regression* describes the process common in education research where it is likely that the child who scores highly on the pre-test will score lower on the post-test. The interval between pre- and post-tests along with the unreliability of measuring tools can increase the likelihood of results that mislead researchers (L. Cohen et al., 2011). In this research, the process lasted over one school year, February to December, so maturation issues needed to be considered and is why the statistical linear mixed-effect model was used.
- *Testing*, particularly using a pre-test/post-test design can sensitise children so that they know what to expect thus inflating the post-test scores. It is also important to use tests that are considered reliable and to be mindful of the human element involved in the testing process. To minimise the ‘human’ element in this research, reflex testing was video-taped so that scoring could be cross-checked as suggested by Cohen et al. (2011). The SDQ is considered a reliable questionnaire and appropriate for the intended use. National standards testing is used in all New Zealand schools and is considered a reliable measure (Ministry of Education, 2011). The time between tests (four months) was expected to minimise children’s sensitivity to the reflex test and DAP.
- *Selection* bias needs to be considered when forming treatment groups and control groups (Creswell & Plano Clark, 2011). Children were assigned individual ID numbers and their

names were removed from the base data (gender, reflex profile and DAP scores) before they were divided into groups. As described in Section 3.2.1.2 the groups were matched for gender, DAP and reflex scores.

- *External validity* relates to the ability of the research outcomes to be generalised to a wider population. The main considerations for this research are highlighted below.
- *Descriptions of the independent variables used:* give a clear understanding of the intervention used (Appendices P and Q). If the variables are not clearly described, the ability to replicate the research is problematic (L. Cohen et al., 2011).
- Having a *strong representation of the population* within the participant group helps with generalisation (L. Cohen et al., 2011). Using mainstream classrooms from a range of locations and socio-economic areas as part of the research design strengthened this research and ensured a stronger and wider representation of the New Zealand population.
- *The Hawthorne effect* is common in medical and educational research (L. Cohen et al., 2011). It was not possible to separate the groups as one group completed the movements and the other group continued with normal programming. Where possible the children completed the movements in a separate area, Kauri and Pōhutukawa had separate areas. However, at Nikau as there was not a separate space, the children went to the back of the classroom, behind the desks, while the control group sat at the front of the classroom completing a teacher-directed whiteboard activity. The control group was encouraged to focus on the activity and not watch the children doing the movements.
- *State reliability scores.* Dependent variables need to be to the highest level of validity possible (L. Cohen et al., 2011). The NZ National Standards testing did not have reliability and validity scores due to the use of Overall Teacher Judgement (OTJ), however the DAP test has been used in several similar studies and has strong reliability scores and the SDQ for parents and teachers is recommended by the NZ Ministry of Health as a reliable screening tool. The reflex tests do not have reliability scores, but they are used by other experienced researchers in this field.
- *Sensitivity to the intervention and the tests* can also impact the external validity giving a false picture of the influence of RMT (L. Cohen et al., 2011). Children may dislike the movements, and in this case, the fact that the class was divided into two groups (intervention/control). This is discussed in Chapter 4.

- *Ecological validity* questions the ability to transfer the results from the experimental setting to an every-day setting (L. Cohen et al., 2011). By completing this quasi-experiment in the classroom this problem is minimised. However, by doing this there were some children who were engaged in school remedial programmes meaning that they will be subjected to *multiple treatments* (L. Cohen et al., 2011), thus making it difficult to be sure as to which treatment influenced the outcomes. In this research, ethically it was not possible to remove children from their existing programmes. Removing them from the participant groups could mean that children with learning challenges would not be part of the research. This would decrease the external validity.

Attending to the issues discussed above increased the validity and reliability of the quantitative data. The next section describes rigour and trustworthiness considerations relating to the qualitative data in this research.

Triangulation. Within qualitative research, triangulation aims to increase data validity and reduce bias. Providing robust data increases confidence in the reported results (Creswell, 2013). Triangulation is a technique where multiple data sources and methods of data gathering are used to match the fixed points of a triangle (Atkinson & Delamont, 2008). Creswell (2013) believes that the variety of data gathered, including the range of theories used to underpin the methodological decisions, enables greater corroboration of evidence. This process also could expose themes or perspectives that may not have emerged through a linear process. This research has assessed the influence of RMT within the classroom as an intervention on student achievement and behavioural outcomes. Data gathered from different sources, NZ National Standards testing, Draw-A-Person, SDQ and reflex tests have been triangulated with the teacher and parent questionnaires and semi-formal interviews. The range of data gathered is a strength of this research. The triangles in Figure 3.15 show where the various strands of data fit in the triangulation process. The first triangle focuses on the overriding research question: What influences does the use of Rhythmic Movement Training (RMT) have in a classroom? and the first two supplementary questions relating to the use of RMT in the classroom. The second and third triangles relate to the supplementary questions focusing on student achievement and behavioural outcome findings and results.

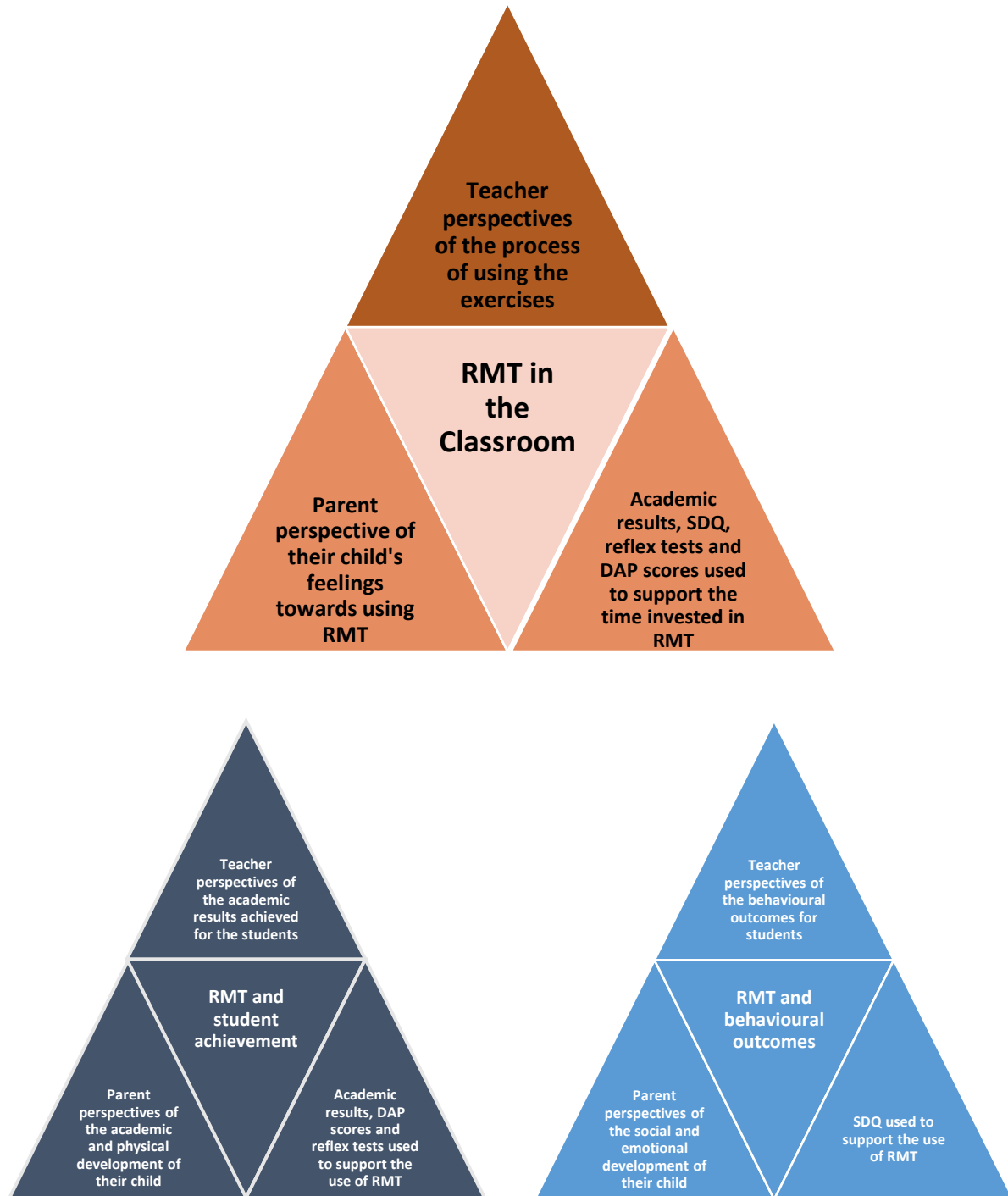


Figure 3.15. Triangulation model for RMT research.

3.4.9 Ethical Issues

Honouring and respecting research participants is essential. Ethical issues also need consideration in relation to the safety of participants and the safety of their data storage at UC. Confidentiality and anonymity are challenges in qualitative research, particularly in smaller communities such as New Zealand (Bogdan & Biklen, 2007; Snook, 2003). The interviewing process may include gathering personal, identifiable information which if quoted in the findings would expose the participant. To maintain anonymity, neither the location of the research nor names have been used. Identifiable events such as the Canterbury Earthquakes of 2010 and 2011 were generalised as much as possible when written about (Snook, 2003).

The voluntary nature of any research needs to be communicated clearly to participants through the informed consent process. This includes the participant's ability to decide to leave the research at any time (Cullen, 2005; Snook, 2003). Schools, teachers and parents were informed that they or their children were able to withdraw from the research and have information withdrawn until January 2018 when results were being formulated. Written consent was obtained from school principals, participant teachers, parents and children (Dockett et al., 2012; Harcourt & Conroy, 2005) and the information about withdrawing was included on the consent form (Appendix E, F, G and H). No participants withdrew during the research, although 3 children moved to different schools and one child reduced his hours at school.

There is a debate about the need to gain consent from younger children. In the past children have not been involved in the consent process with the emphasis being placed on gaining parental approval (Harcourt & Conroy, 2005). However, there is a move towards allowing children to be part of the process (Cullen, 2005; Harcourt & Conroy, 2005). Neill (2005) supports the theory that children, where possible should be given information and consent gained. She believes, as does Cullen (2005), that this is particularly important when qualitative information is gathered. Informing children that confidentiality will be maintained at a high level, but it cannot be guaranteed, is seen as necessary. As Neill comments, research on children's issues has the possibility to benefit all children and this makes it important. However, they are entitled to have ethical standards apply to them, similar to the way adult needs are considered. This goes beyond the notion of doing no harm. In this research, the emotional well-being of the children who were

non-consented was also considered. These children completed the DAPs and the reflex tests as part of their school day. However, the researcher did not follow-up with non-consented children if they missed a testing session. Teachers asked that the non-consented children were not made to feel different or excluded in any way. However, their results were discarded.

Data storage and security are considered essential in ethical research. The quantitative test results, reading, writing and mathematics scores, reflex test scores, SDQ from parents and teachers, and DAP scores collected have been stored securely. All participants were given an ID number. This allowed scores to be disassociated from the names of the participants during the coding and recording processes, thus maintaining a higher level of anonymity and confidentiality.

To ensure anonymity and confidentiality within the qualitative data, pseudonyms have been used (Snook, 2003). Any identifying information has been stored securely and was destroyed at the completion of the research. All data gathered has been securely stored in password-protected facilities in locked storage at the University of Canterbury (UC) and will continue to be stored for ten years following the research. It will then be destroyed. If the results of the research are published, identifiable information will not be used. The location of participants will not be published other than to say that the research was completed in Canterbury, New Zealand.

Transparency about the purpose of the research was considered by the researcher. Parents were informed that this research is being carried out to fulfil the requirements for a PhD thesis under the supervision of Prof Ian Culpan and Dr Wendy Fox-Turnbull from the School of Education, Health and Human Development at the University of Canterbury. Contact details for the University and the Ethics committee were provided in the information letter and consent form.

Participants' rights, particularly those of children, need to be considered when undertaking research. The *United Nations Convention on the Rights of the Child* (UNCRC) (United Nations, 1989) offers children an ethical, moral and legal mandate for protection, provision and participation rights" (Mortari & Harcourt, 2012, p. 234). This may be referred to as the need to 'do no harm'. The term 'harm' needs to encompass physical, psychological (Neill, 2005; Snook, 2003) and spiritual aspects of children and their community (New Zealand Association for

Research in Education, 2010). This means that teacher and parent perspectives and observations were supported without judgement.

Safety of the movements was considered. A safety warning was written in the RMT material regarding the use of a small number of neck movements with children who either have neck injuries or unstable vertebrae (Blomberg & Dempsey, 2011). Teachers and parents were given this information, although none of the movements identified as risky were used with the children in this research.

An application was made to the UC Educational Research Human Ethics Committee for ethics approval (ERHEC, 2009). The committee made recommendations regarding the clarity of information storage, communication as to the risks of doing the movements for children, concern about parents in the focus-group interviews and details on the parent information sheets and minor procedural matters regarding the end of research reporting and self-addressed envelopes. All issues were addressed and communicated to ERHEC (Appendices Ya to Yd). Approval was granted one month before the school consent process began (Appendix Z). This was due to the timing of the Christmas holidays.

Communication about the research process is essential for reliable trustworthy research. Detailed information containing research questions and processes was provided to all research participants prior to the commencement of the research (Appendices A - D). This information was provided in written form and an opportunity to have a verbal explanation was offered to all potential participants. Parents were asked to provide written informed consent to allow their child to participate in the research (Appendix G). It is important that parents are well informed about the research purpose, processes and commitment as participants (Mutch, 2005). Although children were not directly interviewed, their written consent was gained to ensure they understood their involvement in the programme and that their parent knew they are participating in the research. As already discussed it is important to gain consent from children where possible (Dockett et al., 2012) and these six to eight-year-olds are of an age where they could give limited consent.

The bi-cultural nature of the New Zealand community was acknowledged in this research. Honouring the Treaty of Waitangi issues of partnership, participation and protection were

considered during interviews, data analysis and findings presentation. Retained primitive reflexes is not a problem specifically related to Māori. However, there were some Māori children in the participant classrooms. Protection included respecting the information given by participants and it was planned that Māori families would be offered consultation on issues of importance to Māori. This situation did not arise through the data gathering process. An application to the Ngāi Tahu Consultation and Engagement group (NTCEG) was made (Appendix Xa) and a letter of support for the research was received (Appendix Xb). Throughout the data gathering phase, cultural protocols and issues regarding the respect of giving and receiving of information were considered, particularly when visiting schools.

3.5 Summary of Chapter 3

A mixed methods research design has been described in this chapter. Increasing the understanding associated with using the intervention RMT and the complexities of retained primitive reflexes required both qualitative and quantitative information. The quantitative information provides a range of results, but the qualitative data provides a depth of meaning and richness to understanding issues around the use of a reflex integration programme. Decisions made about the possibility of over-testing children may have impacted some results, however of highest importance throughout the research was child and teacher wellbeing.

The findings, results and discussion are found in the next two chapters. Chapter 4 relates to RMT in the classroom, Chapter 5 focuses on the academic achievement of students and behavioural changes discussed by parents and teachers. In both chapters, the findings are presented first, along with any relevant quantitative results and these are followed by a discussion. The structure was developed this way to ensure relevant material stayed together and to minimise the need for repetition.

3.6 Overview of Chapters 4 and 5

Chapter 4 is the first of two presenting the findings, results and discussion of this research. Qualitative research presents ‘findings’ using dialogue while quantitative research presents ‘results’ using numbers, percentages and graphs. As this research used a mixed methods

convergent design, data analysis of the two data sets was conducted separately and then woven together for presentation in a style associated with hermeneutic phenomenology. The hermeneutic process involves the ‘whole’ being broken into ‘parts’ to make greater sense of the ‘whole’ as described in Chapter 3. Although phenomenology is known to be ‘messy’ (van Manen, 1997), separating the qualitative and quantitative data and discussion has the potential to increase messiness and make reading these chapters more difficult. The structure of each chapter is illustrated below in Figure 3.16. Chapter 4 reports on RMT in the classroom and Chapter 5 reports on student achievement and behavioural outcomes.

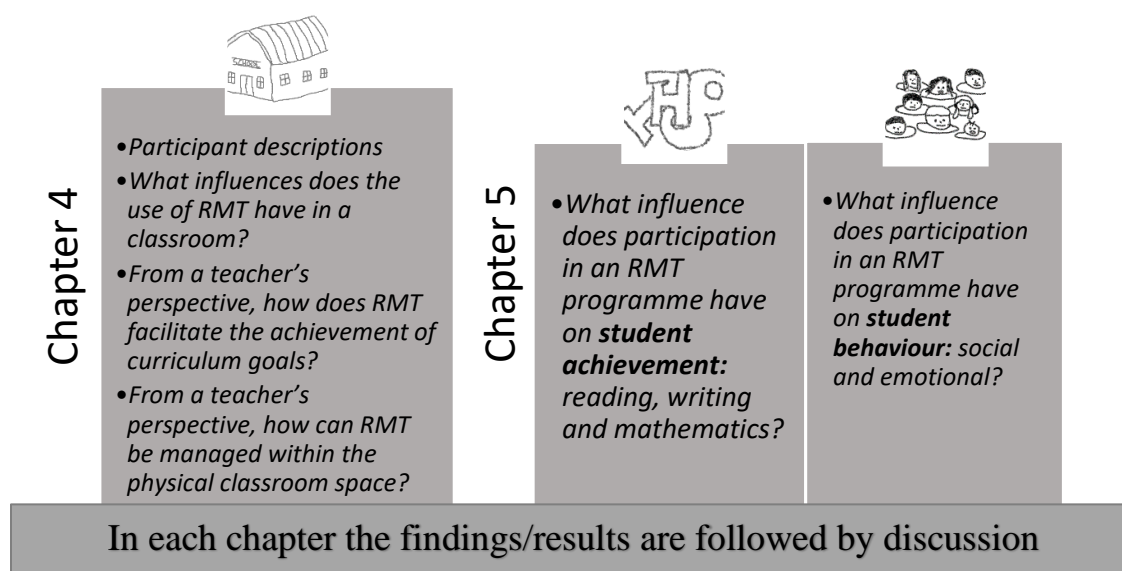


Figure 3.16. Findings, results and discussion structure.

As previously highlighted in Chapter 3, the research design reflects the structure of the reporting and discussion. Three themes emerged from the qualitative data analysis process: RMT in the classroom, changes in student achievement and changes in student behaviour (Figure 3.17). Both qualitative and quantitative data are reported and discussed in relation to these themes. Again, to enhance the clarity and ease for the reader, all data relating to each theme are collated and woven together so that the qualitative meanings of the lived experience have quantitative results as part of the interpretation. The three large circles in Figure 3.17 represent the three main themes, and the small circle represents the voices from which the themes emerged. The very small circle represents a theme that emerged: parent Canterbury ‘quake’ stories as noted in Section 3.4.

Whilst the researcher believed it was important to acknowledge these stories, the research was not designed to document ‘quake’ experiences. The colours in Figure 3.17, green for the themes and blue for the voices, were chosen as they relate to the sections the themes and voices are placed within the methodological rainbow (Figure 3.1) used at the beginning of Chapter 3. The themes were found through the data analysis section of the rainbow and the voices came from the parent/teacher section.

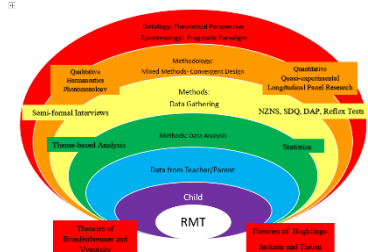
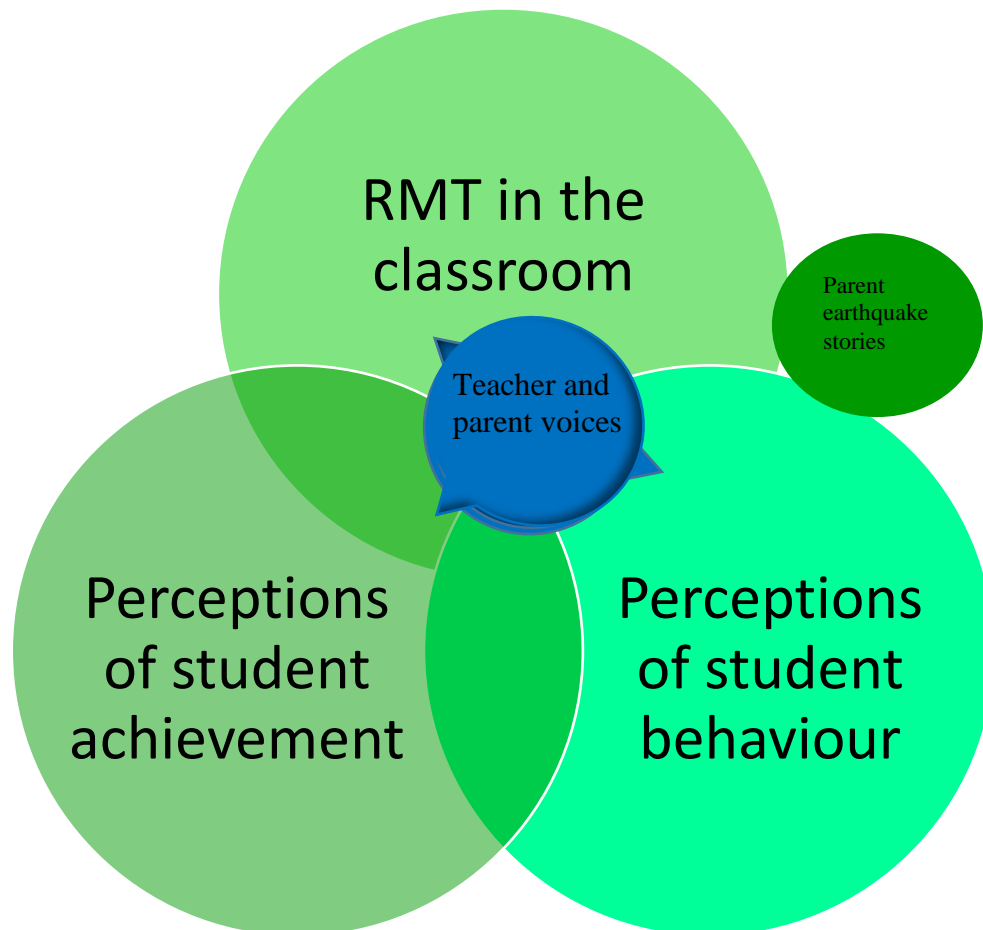


Figure 3.17. Emergent themes and Figure 3.1. Research Overview (repeated).

Chapter 4 The Classroom: Findings, Results and Discussion

4.1 Introduction:

Chapter 4 focuses on the classroom, its participants and how the teachers managed RMT within their programme. The first section extends the participant descriptions described in Chapter 3, focusing on the independent (control) variables such as gender, SES status, retained primitive reflex profile and the matching of group 1 (intervention/movement) and group 2 (control). Another factor noted is the effect of the Canterbury earthquakes of 2010 and 2011. These children were young (*in utero* – 18 months) when the earthquakes occurred making this event part of their chronosystem as described in Bronfenbrenner's bio-ecological theory (Bronfenbrenner, 2005; Guhn & Goelman, 2011).

Secondly, data relating to the research question: *What influences does the use of Rhythmic Movement Training (RMT) have in a classroom?* will be addressed. Teacher comments and perceptions relating to the ease with which RMT was used within the classroom are presented and discussed. Two supplementary questions will also be covered:

- 1: *From a teacher's perspective, how does RMT enhance curriculum goals?*
- 2: *From a teacher's perspective, how can RMT be managed within the physical classroom space?*

Recorded in this section is the number of days each group completed the movements and the frequency per week of the movements. This data is useful if the research is to be replicated or compared. Bronfenbrenner's process-person-context-time theories (Guhn & Goelman, 2011) will be analysed in relation to all three questions in the discussion section.

4.2 Participant Group Descriptions

This section describes the matching of the two groups, accounting for participant SES and gender in relation to their reflex profile and DAP scores as described in Chapter 3. The RMT intervention was a multiple baseline, longitudinal panel design. There were two evenly matched groups, group 1 (intervention, $n = 52$) and group 2 (control, $n = 46$). Within each classroom, half the children were assigned to group 1 and the other half were assigned to group 2. Draw-A-Person scores and reflex scores were used, along with gender to ensure the groups included a mix of high and low scores on both tests. The graphs and tables in this section show the levels at which the groups were matched. Table 4.1 shows the number and percentage of children in each group.

Table 4.1. *Number of Children in Each Group*

School	Total number of children in the class	Number of consented children in the class for the whole year	Non-consented children and children who left the school	Number of consented children in group 1 – Intervention	Number of consented children in group 2 – Control
Nikau: Decile 9 High SES	26 (19.26%)	22 (22.45%)	2 children left the school, 1 child was new, and 1 child was not consented. $N = 4$ (10.81%)	12 (23.07%)	10 (21.74%)
Kauri: Decile 5 Mid SES	69 (51.11%)	50 (50.02%)	2 left the school and 1 reduced his hours, 16 not consented. $N = 19$ (51.35%)	25 (48.08%)	25 (54.35%)
Pōhutukawa: Decile 2 Low SES	40 (29.63%)	26 (26.53%)	1 left the school, 2 new children. 11 not consented. $N = 14$. (37.84%)	15 (28.85%)	11 (23.91%)
Total number of children	135 (100%)	98 (100%)	37 (100%)	52 (100%)	46 (100%)

Care was taken to ensure that the control and intervention groups were evenly matched, but to confirm this the beginning scores of all participants were statistically analysed. The *p-values* for

all tests are > 0.0500 and do not detect statistically significant difference between the control and intervention group at Day 0 (Table 4.2).

Table 4.2. *Statistical Group (Intervention and control) Matching Tests at the Beginning of the Research*

Test	test stat (<i>t</i>)	<i>p</i> -value
Reflex	-0.56	0.5763
Draw-A-Person	-1.04	0.2973
Reading	-1.75	0.0824
Writing	-1.40	0.1637
Mathematics	-0.92	0.3583

4.2.1 Reflex Profiles of Participants

All participants were tested for the presence of three primitive reflexes: TLR, ATNR and Spinal Galant. The reasons for choosing these three reflexes and scoring system has been described in Section 3.3. Each reflex test had a possible score between 0 and 4. When all scores were added together the single score was called the reflex profile with a possible maximum score of 12.

Figure 4.1 shows the spread of reflex profile scores of these six to eight-year-olds with 3.06% ($n = 3$) scoring 0 and 96.94% ($n = 95$) scoring between 1 and 9. A low score is beneficial for the child, with full integration (a score of 0) optimal. The results in this research are higher than the scores recorded in Gieysztor's (2018) study where she found 11% of four to six-year-olds had fully integrated primitive reflexes and 89% had some level of retained primitive reflex. This difference is one of the reasons that the Canterbury earthquakes became of interest.

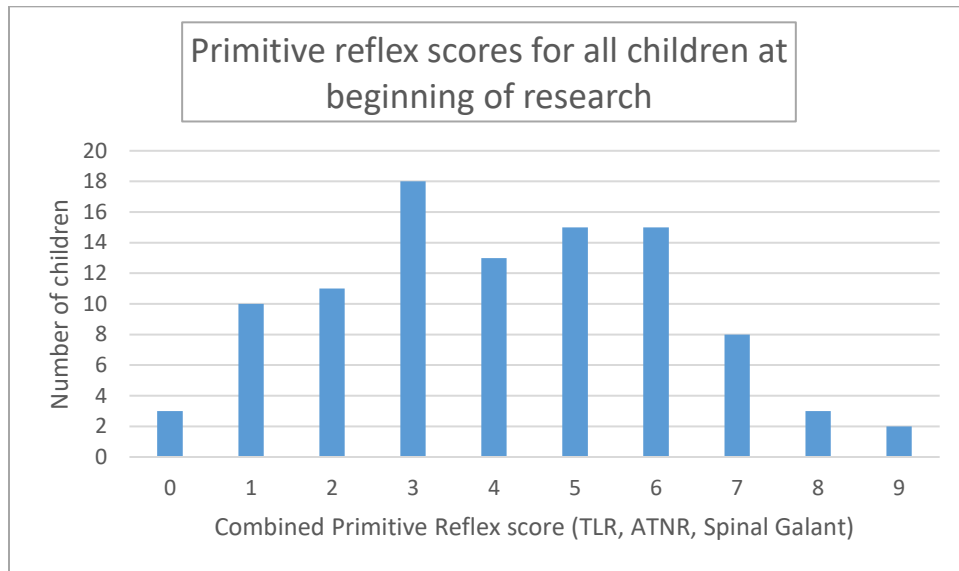


Figure 4.1. Primitive reflex profile scores for individuals.

The graph in Figure 4.2 shows that from the total number of children in the control ($n = 52$), 21.15% ($n = 11$) of children scored between 0 and 2, and 78.85% ($n = 41$) scored between 3 and 9. In the intervention group, from the total number of children ($n = 46$), 28.26% ($n = 13$) of them scored between 0 and 2, and 71.74% ($n = 33$) scored between 3 and 9. This shows that there were

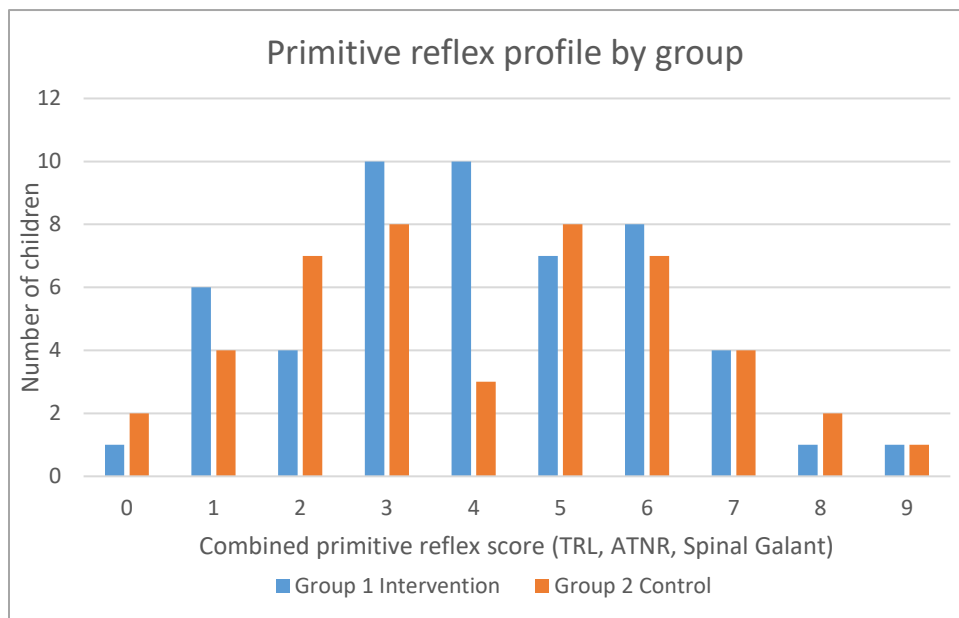


Figure 4.2. Primitive reflex profile scores for each group.

slightly more low-scoring children in the control group and slightly more high-scoring children in the intervention group and it could be argued that these children in the intervention group had higher levels of reflex retention.

Table 4.3 shows that the TLR and ATNR were more likely to be present in the participants at the beginning of the research. The Spinal Galant reflex was the least likely to be present.

Table 4.3. *Primitive Reflex Test Scores for Each Reflex*

Score	TLR	TLR >1	ATNR	ATNR >1	Spinal Galant	Spinal Galant > 1
0	9	9	19	19	33	33
1	30		45		31	
2	42		29		19	
3	14	89	4	79	15	65
4	3		1		0	
Total	98	98	98	98	98	98

The results presented in Table 4.3 shows that at the beginning of the research 90.82% ($n = 89$) children received a score of 1 or more for the TLR, 80.61% ($n = 79$) received a score of 1 or above for the ATNR and 66.33% ($n = 65$) of children received a score of 1 or above for the presence of the Spinal Galant. This indicates that this group of children are more likely to have a retained TLR and ATNR rather than a retained Spinal Galant. Scores at the high end (a score of 3 and 4) were Spinal Galant 15.31% ($n = 15$), ATNR 5.10% ($n = 5$) and TLR 17.35% ($n = 17$) and these are lower than the 25% found in Gieysztor's (2018) research using the same reflexes.

Table 4.4 shows the mean scores for the control and intervention groups as well as the levels of frequency (four or more times per week or less than four times per week) per week with which the movements were completed at the three test points during the research. Male and female mean scores are reported. Overall the mean reflex profile scores reduced over the 216 days, the intervention group reducing 4.08 (2.04) to 1.63 (1.58) more than the control group 4.11 (2.27) to

2.24 (2.02). However, the greatest reduction in reflex profile scores was in the four or more times per week children 4.37 (1.93) to 0.90 (1.52).

Table 4.4. *Coefficient Estimates for Reflex Profile using Model 1: Group*

Reflex Profile	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the control group at Day 0	4.17	0.28	14.63	<0.0001
Expected difference in response of the Intervention and control group at Day 0	-0.23	0.39	-0.58	0.5569
Expected effect of adding days to the control group	-1.88	0.28	-6.58	<0.0001
Expected difference in the effect of adding days for the Intervention and control groups	-0.52	0.39	-1.33	0.1844

Table 4.5 *Mean Reflex Profile Scores*

Group	Reflex Profile Scores at Time 0 (Day 1)			Reflex Profile Scores at Time 1 (Mid-point Day 94)			Reflex Profile Scores at Time 2 (Completion Day 216)		
	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)
Control	4.11 (2.27)	4.29 (2.03)	3.91 (2.54)	3.48 (1.94)	3.63 (1.74)	3.32 (2.17)	2.24 (2.02)	2.38 (1.74)	2.09 (2.33)
Intervention	4.08 (2.04)	4.42 (2.23)	3.08 (1.80)	2.67 (1.64)	2.69 (1.52)	2.56 (1.79)	1.63 (1.58)	2.23 (1.66)	1.04 (1.28)
<4/week	3.99 (2.21)	4.34 (2.09)	3.64 (2.29)	3.32 (1.94)	3.57 (1.67)	3.08 (2.17)	2.50 (1.87)	3.18 (1.40)	1.96 (2.03)
>=4/week	4.37 (1.93)	4.40 (2.26)	4.33 (1.61)	2.33 (1.24)	2.13 (1.25)	2.58 (1.24)	1.31 (1.57)	1.61 (1.43)	0.90 (1.52)

Note. M = Mean SD = Standard Deviation

Table 4.5 shows that the control group's reflex profile drops 1.88 during the research (5 months) the intervention group drops 2.40. A statistically significant effect was not detected ($p = 0.1844$). When the frequency of the movements was considered (Table 4.6) the four or more times per week dropped 2.81 and the less than four times per week dropped 1.71 over the research period.

Table 4.6. *Coefficient Estimates for Reflex Profile using Model 2: Frequency*

Reflex Profile	<i>Estimate</i>	<i>Std - error</i>	<i>t</i>	<i>p-value</i>
Expected response for the ≥ 4 /week group at Day 0	4.21	0.33	12.42	<0.0001
Expected difference in response of the < 4 /week and ≥ 4 /week groups at Day 0	-0.21	0.41	-.51	0.6040
Expected effect of adding days to the ≥ 4 /week group	-2.81	0.33	-8.36	<0.0001
Expected difference in the effect of adding days for < 4 /week and ≥ 4 /week groups	1.10	0.46	2.39	0.018*

A statistically significant effect was detected ($p = 0.0180$). This indicates that reflex profile scores were affected when the RMT movements were used four or more times per week in the generic manner of the classroom setting. This is reported on in Section 4.4. It is not clear why the control group scores reduced as maturation implications at this age would not be considered a strong influencing factor. It is possible that other sport based activities included movement that aided the reflex profile reduction due to the fact that the children continued to participate in their normal sport activities during the research.

4.2.2 Earthquakes and the Child's Birth

During the research process, a question arose about the high levels of retained reflexes within this group of participant children from Canterbury. The children were chosen because they were in a Year 3 class as has been described in Section 3.4. Following the completion of the first set of reflex profile tests at the beginning of the research, it was noted that three children out of 98

consented children tested had a score of 0, meaning their reflexes were fully integrated and ten children scored a total of 1. The researcher did not initially collect date-of-birth data to reduce testing bias and the high reflex scores were puzzling until the realisation that many of these children were of the age when they would have been infants at the time of the Canterbury earthquakes of September 2010 and February 2011. Mutch (2017) found that the impact of the Canterbury quake on school communities and teachers was extensive and in particular for schools that were closed. A study in 2017 (Thornley, Ball, Signal, Lawson-Te Aho, & Rawson) highlighted the stress associated with the Canterbury earthquakes and the need to build community resilience. With stress implicated in primitive reflex retention (Goddard-Blythe, 2008; Goddard, 1996), it is one possible explanation for the high levels in the children's reflex profiles. To assess this finding, a group of children were tested in a North Island town chosen because of its low levels of community wide stress events; the area had not experienced geological events such as earthquakes, or weather events such as flooding (The ERHEC committee was notified of the slight change in focus for this testing (Appendix V)). The aim was to compare reflex test results and to check the researcher's theory about the 'quake' effect. Differences in the two groups were noticed, the North Island children had lower reflex profiles overall than the Canterbury children but it was decided to keep the focus of this research on the original intention, and not change it to 'earthquake' research. This may be of interest in the future. Approximately half of the Canterbury participants ($n = 56$) were between six months and three years old, 26 were under six months old and 15 were *in utero* when the September earthquake struck (Figure 4.3).

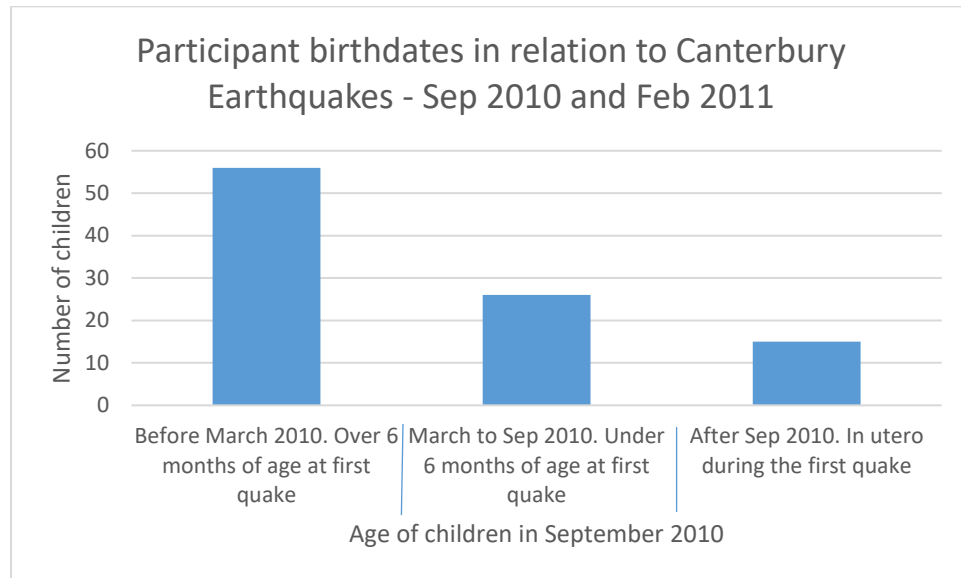


Figure 4.3. Percentage of birthdates in relation to Canterbury earthquakes.

Having discovered the ‘earthquake’ aspect of the participant group, parents were asked about this during the interviews. One child was born just after the September quake:

His birth, he was a caesarean, he was born during the earthquakes, so his birthday is the XX September, and the earthquake was the 4th. So, we were still in hospital, it was really weird, ‘cos he never ever sleeps with me, and that night he was in my bed. So, I just woke up and his bassinet went backwards and forwards, but he was with me, and because I had had the caesarean I had only just started walking that Friday. So, he wasn't too bad, but when he first started crawling he used to tap everything twice. And he has just grown up with it, so he doesn't know anything different (Mary).

Another child was also born just before the quakes:

I hate to say it, but it was, he was born just before the earthquakes, my first day home was just when the earthquakes hit. So, I feel like it was a bit of a blur, you know, besides being sleep deprived and all that.... but I feel bad for him, I don't remember his first six months, as much as I did with the others. It is just a bit of a blur, you know dealing with the power cuts, and the stuff going on. And we weren't even in a house that was damaged, I do think often "Oh that period is just a bit of a blur" (Miranda).

A mother who was heavily pregnant at the time of the earthquakes had this to say:

Yep, that was an interesting time. Looking back on it I was probably very shell-shocked, I guess you could say. I never liked earthquakes, and then, just having to deal with that and being pregnant, and my midwife was like, "Prepare for a home-birth because I don't even know if we can get up to the hospital". So, it was actually quite lucky cos we had prepared with extra towels (Anne).

As discussed in Chapter 2.2, maternal stress is identified as a factor in interrupting the reflex integration process and it is possible that the Canterbury earthquakes had an impact on this group of children (Goddard-Blythe, 2008; Goddard, 1996; Mutch, 2017; Thornley et al., 2015).

4.2.3 SES and Retained Primitive Reflexes

The spread of SES for the research showed that the majority, 50.02% of the consented children, came from the decile 5 school – middle SES, with 22.45% from the high decile school and

Table 4.7. *Pairwise Comparisons using t-tests with Pooled SD*

	Decile 2	Decile 5
Decile 5	$p = 0.0096$	
Decile 9	$p = > .9999$	$p = 0.0760$

26.53% from the low decile school (Table 4.1). There were more (37.84%) non-consented children and children who left the school in the low SES group and fewer (10.81%) non-consented children and children who left the school in the higher SES group. In Chapter 3 (Table 3.7 and Table 3.8) it was noted that when compared to the New Zealand population, the participant group had more children in the middle SES group and fewer children in the higher SES group, and the lower SES group was at a similar level. An analysis of variance (ANOVA) test was performed using reflex profile across the decile rating of each child's school. Using a Bonferroni correction adjusting for completing multiple tests, the p-values in Table 4.7 detect a statistically significant difference between the reflex profiles in decile 2 and 5 ($p = 0.0096$) but not between decile 9 and 2 ($p = > .9999$) or decile 5 and 9 ($p = 0.0760$).

The boxplot in Figure 4.4 shows that the children in the decile 5 school had higher reflex scores at the beginning of the research than the children in the decile 2 and decile 9 schools. This is contrary to findings by McPhillips et al. (2007a), Brown (2010) and Callcott (2012), where low SES was identified as a factor in retained primitive reflexes. As already reported the Canterbury earthquakes may be a factor in these scores, but that was not fully assessed in this research.

4.2.4 Gender and Primitive Reflex Retention

Comparing levels of motor development with gender has been noted in primitive reflex integration research by McPhillips, Jordan-Black (2007b), Brown (2010) and Callcott (2012). They found that higher levels of learning challenges and primitive reflex retention present in males when compared to females. Table 4.8 shows the gender spread within the schools. The spread of males and females within the participants of this research was even: males ($n = 50$) and females ($n = 48$) within the total ($n = 98$).

Table 4.8. *Participant Gender Proportions*

School	Consented Males	Consented Females	Total
Nikau	11 (50%)	11 (50%)	22 (100%)
Kauri	22 (44%)	28 (56%)	50 (100%)
Pōhutukawa	17 (65.38%)	9 (34.62%)	26 (100%)
Total	50 (51.02%)	48 (48.98%)	98 (100%)

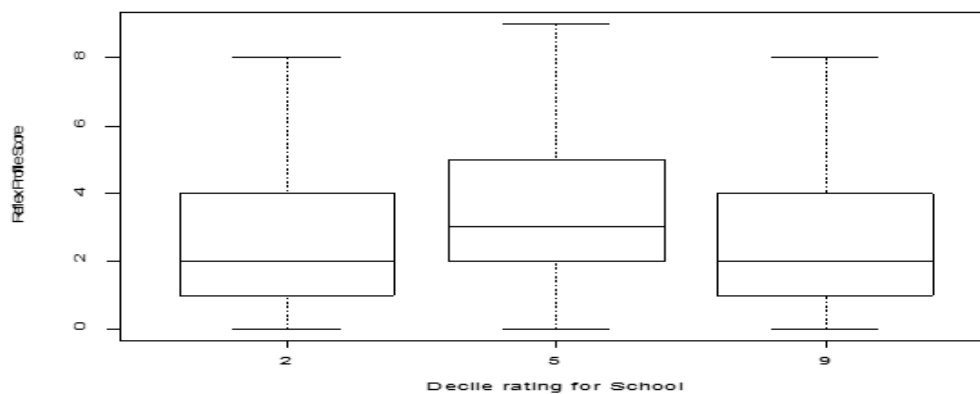


Figure 4.4. Boxplot showing reflex profile scores in relation to school decile rating.

The results in Table 4.9 show that male students had a higher reflex profile than female students at the beginning of the research. The mean score for female students at Day 0 was 3.90 and the mean score for males was 4.35. Table 4.9 shows the statistical difference between males and females is 0.52 but the analysis did not detect a statistically significant level ($p = 0.1844$). This research tested three reflexes which may have influenced the results, but when McPhillips and Jordan-Black (2005; 2007b) tested for ATNR persistence they found higher rates for males than females ($F(1, 737) = 15.21, p < 0.001$).

Table 4.9. *Coefficient Estimates for Reflex Profile and Gender using Model 1: Group*

Reflex Profile	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the control group females at Day 0	3.90	0.32	11.85	<0.0001
Expected difference in response of the Intervention females and Control group females at Day 0	-0.21	0.39	-0.56	0.5763
Expected effect of adding days to the control group females	-1.88	0.28	-6.58	<0.0001
Expected effect of adding days to the control group males	0.52	0.31	1.65	0.1013
Expected difference in the effect of adding days for the Intervention and control groups	-0.52	0.39	-1.33	0.1844

4.2.5 Discussion

This discussion focuses on the description of student participants, their reflex profile scores as a dependent variable and the explanatory variables of gender and SES. The effect of the RMT intervention in relation to reflex profiles is also discussed. Theories from Hughlings-Jackson (Konikarova & Bob, 2013b), Bronfenbrenner (2005) and are highlighted in relation to these participants and the retention of primitive reflexes, with a particular interest in the child's ability to participate within their environment and their development.

Participant Group and Reflex Profiles. Retained primitive reflexes have been shown to have a link to student achievement and behavioural outcomes. Hughlings-Jackson's theory regarding the retention of primitive reflexes was discussed in Chapter 2. He linked human psychopathology and the 'dissolution' of the primitive reflexes. Gieysztor (2018), Goddard (1996) and McPhillips (2004), also discussed in Chapter 2, have linked achievement in educational settings with the retention of primitive reflexes. The group of participants in this research showed higher than expected levels of retained primitive reflexes as presented in Section 4.2. Testing of three primitive reflexes showed that this group were more likely to have retained their TLR and/or ATNR reflexes than Spinal Galant. Whilst it is not fully understood how reflexes integrate, both the TLR and ATNR reflexes are postural based, relying on opportunities to complete their integration through movement. It is possible that this group of participants did not have as many movement opportunities available to them after the earthquakes. Playgrounds were damaged, parents were anxious about children being close, sports facilities were closed, and parents were coping with the stress of damaged houses so less-able to spend time seeking movement opportunities for their children. Another possibility to consider is that current lifestyle and culture may have an impact, as children generally have fewer opportunities to move and engage in physical activity than earlier generations. They are transported by car from place to place (45% of children in NZ used active transport to school in 2016, e.g., biking or walking (Ministry of Health, 2018)), they spend hours in front of screens, (50% of children watched two or more hours of television each day in 2016 (Ministry of Health, 2018), locking their eyes and bodies into stressed positions.

The third reflex tested, Spinal Galant, is triggered and partially integrated, by touch. It is possible that as a result of the earthquake the children, as infants, were held closer, tighter and more often, by their parents than may have been the case if the earthquake had not occurred, which may have assisted the Spinal Galant to integrate more fully than either the TLR or ATNR. The complexity of the retained primitive reflex issue has been considered in the design of the research, giving high value to capturing data relating to both achievement and behaviour. The results show that the reflex profile of the children reduced when RMT movements were used four or more times per week showing greater levels of integration.

Also, previously mentioned, the participant children in this research were either *in utero* or young when the Canterbury earthquakes struck (Figure 4.3). This sets them apart from other New Zealand children, making their chronosystem, as described by Bronfenbrenner (Bronfenbrenner, 2005; Guhn & Goelman, 2011), relevant to their developmental path. There were changes to the range of activities these children had available to them, swimming pools were closed and playgrounds damaged. Parents were focused on home repairs and it is possible that they devoted less time to the play and sport of their children. Thelen's (Spencer et al., 2006) theories place importance on the early movements children make, but for many of these children, the movement opportunities may have been reduced due to the timing of their birth or their time as toddlers. The quality of the microsystems and mesosystems were disrupted for some children and as Bronfenbrenner believes, the quality of the interactions within a child's 'systems' influence development.

SES and Reflex Retention. Previous studies (Brown, 2010; McPhillips & Jordan-Black, 2007a) relating to retained primitive reflexes and student achievement have focused on children from low SES groups. These researchers observed the prevalence of retained primitive reflexes to be higher in these groups. However, there are also children in higher SES groups with reflex issues and having these children represented in this research was considered valuable. Maternal stress and birth stress have the potential to affect all children and the RMT intervention was viewed in this way. With research showing higher levels of primitive reflex retention in children from low SES backgrounds due to increased levels of maternal stress and lack of resources to mediate the stress, the effect on this section of the population could be higher. The results for this group of participants showed that overall there was no statistically significant difference between the reflex profiles of children with different SES although the children in the middle SES group showed statistically higher levels of retained reflexes than the lower SES group. The possible explanation for this is that the Canterbury earthquakes affected the whole area, and many of the children in the research had experienced that event. The low decile area was particularly affected and it is possible that more families moved away from the area, and the high decile area was not so severely affected. However, this research did not set out to answer questions surrounding the trauma of an earthquake and the relationship to retained reflexes. What is highlighted is that children from all backgrounds have the potential to experience retained primitive reflexes.

Gender and Reflex Retention. Males have been over-represented in studies of learning and behaviour challenges (Kerneža & Košir, 2016; Venkata & Panicker, 2013). They have also been identified as having higher retained primitive reflex profiles when compared with females (Callcott, 2012; Jordan-Black, 2005). Table 4.9 showed male students with higher levels of reflex retention and this is similar to results found by Callcott (2012). However, statistically significant levels were not detected between male and female students. It is unclear why this research does not support the findings of others (Jordan-Black, 2005; McPhillips & Jordan-Black, 2007b) who only tested the ATNR. Grzywniak (2017) and Goddard-Blythe (2005) tested multiple primitive reflexes but neither researcher reported on gender as a variable. Gender variability is an area where greater understanding would be gained through further research. Do males retain reflexes other than the ATNR at higher levels than females? Within a school setting, it is possible that male students could receive additional targeted assistance, but the levels of primitive reflex retention shown in this research were such that female students could also benefit. Hughlings-Jackson's (Konicarova & Bob, 2013b) theory linking psychopathology and retained primitive reflexes provides an additional approach to diagnoses such as ADHD. Alongside established treatment procedures, the consideration of retained primitive reflexes as a possible maturity inhibitor would be worth considering as in Perry and Hambrick's (2008) Neurosequential Model of Therapeutics (Section 2.3).

4.3 RMT in the Classroom

This section reports on the perceptions of teachers and parents in relation to the use of RMT in the classroom and the length of time the movements were used. The relationship between using RMT in the classroom and the NZ Curriculum is also highlighted (Ministry of Education, 2007). Seven teachers were interviewed for this research using a semi-formal interview process described in Chapter 3. Agatha had been using RMT with her class for 18 months, and the other six teachers had been using RMT for 10 months at the time of the interview. All teachers had between five and 25 years of classroom teaching experience giving them the ability to compare classes of a similar age from different years.

The teacher comments in Section 4.3 reflect the use of the movements in two situations. As described in Chapter 3, four teachers used the movements where they had a control group and an

intervention/movement group within their class. Nikau was a single teacher class, Pōhutukawa was a 40-child class with two teachers and Kauri was a 69-child class with three teachers. Two teachers at Kauri did not directly experience the control/intervention experience, Betty used the movements all year with her group and Stanley used them for five weeks with his group. However, all children in the 69-child class were taught by all three teachers. Agatha was not part of the data-gathering group of schools and so did not experience the intervention/control situation.

Six of the seven teachers commented that the movements were easy to use within their classroom. These six teachers all answered this question quickly and with an enthusiastic tone (observations November, December 2017). When asked what it was like to use RMT in their classroom they made the following comments:

It has been good. Iris has been very good at finding wee moments during the day that we can do that (Mildred).

It was certainly was a big commitment that I wanted to focus on and get right, so we did spend a lot longer doing them initially, getting the right movements and getting the children to do them the correct way (Agatha.)

Oh, good, easy. We do it normally after lunch and they'll know, and they'll find a find a space for "Tessa's exercises" and L (child) comes, gets my phone and they run it themselves. They all know what they are doing. It's lovely. So, it is great. They know what they are doing. They've got it down to a fine art, they (the movements) are working really well. They (the children) are comfortable with them (Iris).

Without prompting, the teachers also commented that as well as being easy to use they wanted to carry on with the movements next year.

It has been very easy. Once the children knew the exercises, I just set them to it every morning.... Nothing was hard. It was so easy to do every day and there were never any issues. So simple that we ... I'd like to carry on next year... (laughs) (Gwen).

Good. Yep, Good. I think I was probably the most consistent because I started off. And it is something I am going to do next year, carry it on (Betty).

Fine, it was quick and easy. Once we got into a little routine, it got a bit easier. And they yeah, it was a lot easier when we could just do the whole class, rather than the core group (Edith).

Edith had a group where half of the children were completing the movements and the other half were in the control group. Edith's teaching space was next to Betty (her group completed the movements all year). Several teachers made similar comments about managing the divided

group. At the completion of the data gathering, five of the seven teachers started the following year using the movements with their class. They commented that it was so much easier with the whole group doing the movements from the start of the year.

The teacher who found the movements challenging to establish was Stanley in Kauri 3. His group of children had been assigned as the control for the 69-child class and as already stated there were challenges in establishing the routine.

Yeah, they knew what to do because I think they had seen others and had a little bit of exposure. But I think for this class it was hard to get the consistency with it, because I am away one day of the week, and then if (the relief teacher) doesn't pick it up, or if I am away because of appointments and stuff, it's hard to get it consistent (Stanley).

During visits to each school, the accuracy with which the children were completing the movements was checked. Individual children were helped by a teacher or the researcher when needed, but mostly they appeared to willingly start their movements. It was evident that many children enjoyed the movements when the researcher returned the following year to help them get started. Many children gave encouraging exclamations such as “Yeah” and “I like those”. One child was asked why he liked the movements and he said: “cos they make me feel nice”. The ability to engage children and teachers is an important aspect in the implementation of a programme that uses classroom time. However, additions to a classroom must also add value to the curriculum and these are highlighted in the next section.

4.3.1 The New Zealand Curriculum and RMT.

The NZ Curriculum is the document used in New Zealand as the basis for programme development and learning within classrooms (Ministry of Education, 2007). General Key Competencies are provided in the document and each learning area has more specific competencies detailed for each level. Curriculum areas are integrated and the Key Competencies are also woven through all curriculum areas. Figure 4.5 shows the five key competencies as documented in the NZ Curriculum: *thinking, using language, symbols and texts, managing self, relating to others and participating and contributing*. Aspects of RMT as they relate to the competencies are reported and expanded upon within the sections of this Chapter. Using

language, symbols and texts are competencies not directly targeted in the completion of the movements, but in Chapter 5 the results of achievement tests show changes in children's relationship with language and text while they were using RMT. The complexity of the RMT movements also falls within the health and physical education competencies of the NZ Curriculum. Practising the RMT movements can increase children's physical abilities and well as increasing muscle tone. Physical abilities were not tested as part of this research but reflex integration has been reported to improve gross motor skills (Grzywniak, 2017) and fine motor skills (Brown, 2010). In two classrooms children were counting in their heads the number of repetitions of each movement and this is aligned with one of the mathematics competencies – counting forwards and backwards. There is an opportunity for the teacher to choose the place the children start counting from and in which direction they count. For example: “Start counting at 50 and stop at 80” or “Count backwards from 30”.

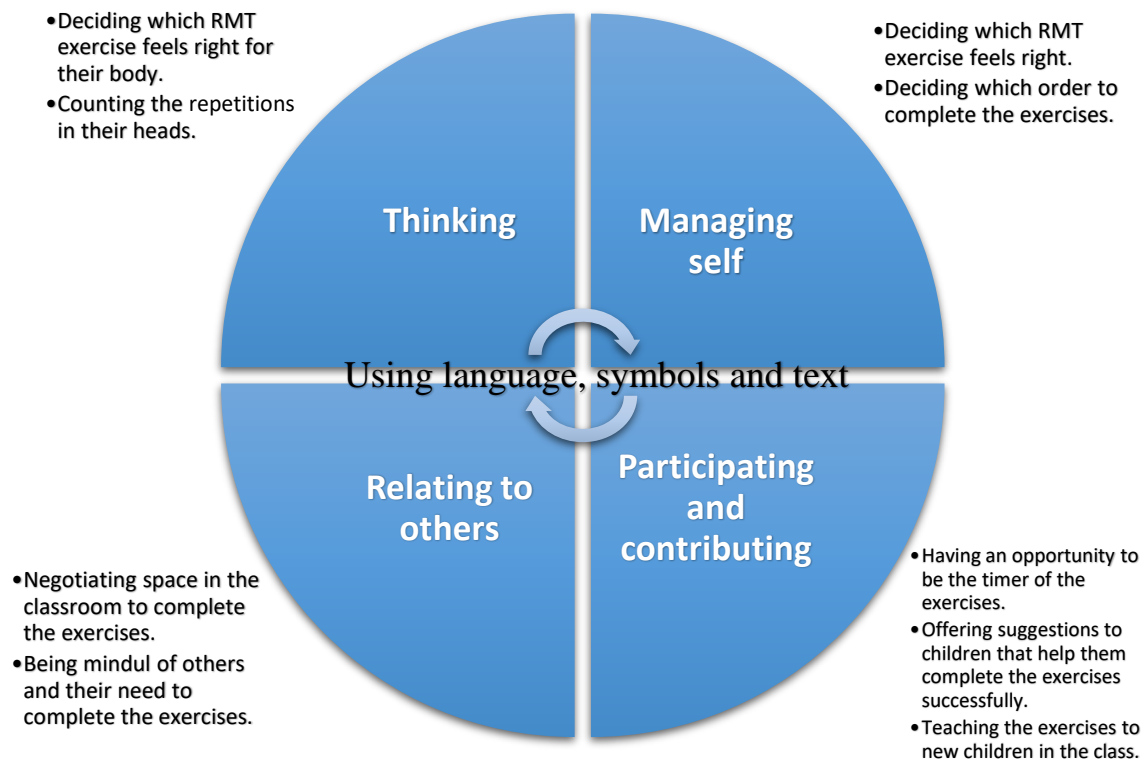


Figure 4.5. RMT in relation to NZ Curriculum key competencies.

4.3.2 Number of days completing RMT movements

How long do children need to complete RMT and when will changes start to be noticed? This question is partially answered in this section, as without supporting evidence for RMT use, it was an aspect that needed further investigation. The time it takes to integrate primitive reflexes has many variables such as environment and nutrition (Blomberg, 2015) and these issues are not included in this thesis. When integration of the primitive reflexes takes place, cognition is the basis of action and development rather than reflexes. In the same way that a medical doctor taps under the patient's knee to assess the presence of a knee-jerk or patella reflex, primitive reflex integration can be assessed through the physical tests described in Section 3.4. Fully integrated

primitive reflexes will allow cognition to control execution of the demonstrated movement. However, movement has been shown (Section 2.3) to assist the integration process and the studies cited used their integration programme for one school year or more (Brown, 2010; Goddard-Blythe, 2005; Grzywniak, 2017; McPhillips et al., 2000). This research does not answer ‘how’ the reflexes are integrated. Are there patterns in the order that reflexes integrate, and what levels of individualisation are there? These are questions for further research. This research was focused on the use of generic RMT movements, and recorded the changes in reflex profiles, achievement and behavioural outcomes.

The number of days each group completed the RMT are shown in Figure 4.6. Holiday weeks, when children were not at school, were excluded as the first phase (intervention/control) had two weeks and the second phase (all using intervention) had four weeks’ holiday. While every effort was made to make the intervention weeks the same, using different schools to increase the diversity of the groups made this a challenging task. Within the first phase, the number of days using RMT ranged from 52 to 88. During the second phase, when all the children were completing RMT, the number of days ranged from 101 to 119. One group completed 35 days of RMT due to teacher illness and a death in the researcher’s whānau (extended family). With the movements not established within the classroom routine, it was difficult for the teacher in this classroom to maintain RMT.

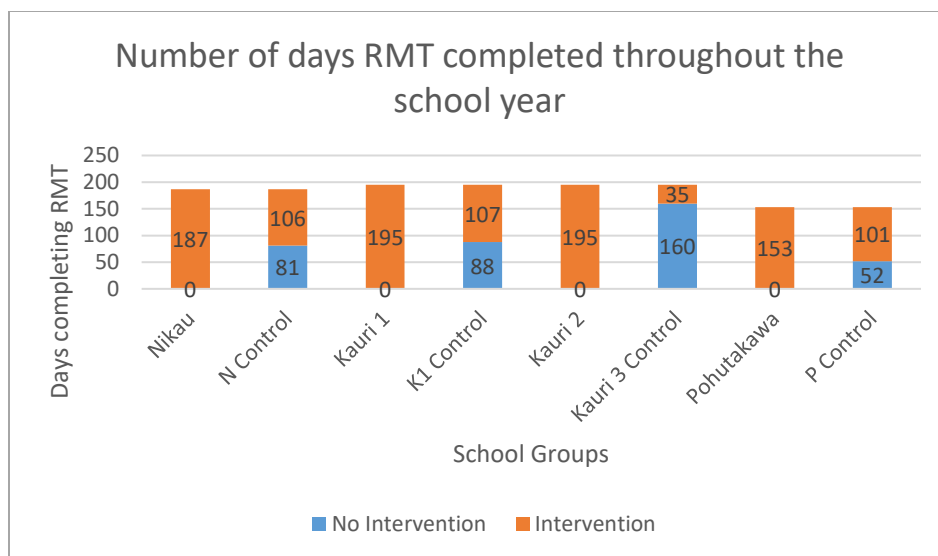


Figure 4.6. Number of days RMT used during the school year.

An educated estimate, based on researcher experience and in consultation with experienced RMT users, was made as to the number of weeks the children would need to complete the movements so differences would be noticeable. Table 4.9 shows that no statistical difference ($p = 0.1844$) was detected when the reflex profiles of the two groups were compared over the year the research was completed. This implies that duration alone, completing the movements, was not the only factor that needed to be considered. The generic nature of the use of the movements is presented in the next section: the frequency with which the movements are completed determines the level of difference between the two groups in relation to the integration of primitive reflexes.

4.3.3 Frequency

Differing rates of the frequency with which the movements were completed each week in the classroom was noted during the qualitative data gathering. The statistical analysis reported in Section 4.2 showed that frequency was a factor in the reduction of the reflex profiles with children using the movements four or more times per week showing greater levels of primitive reflex integration ($p = 0.018$). The structure of the classroom and the demands of the daily programme appeared to be determining factors. During the first phase, it was challenging for Kauri to complete the movements as the participants were divided across teacher ‘home groups’ and additional teacher negotiation was required. The timing of assemblies and other large group

activities also impacted on the completion of the movements. The ease with which the programme was able to be integrated into the programme reflected the teacher engagement with RMT. The teachers who managed to complete the movements four or five days a week noticed greater changes in their children and this is reflected in the quantitative results for reflex profile scores. As far as frequency of the completion of the movements, Agatha managed to complete them five days, but Kauri 1 and 2 averaged three days per week and Pōhutukawa and Nikau averaged four days per week.

Gwen found that RMT worked best for her if it was attached to the morning routine.

I would just set them to it every morning straight after roll call, they were all into doing it (Gwen).

Agatha also completed the movements in the morning on most days. She adapted the movements to fit the school programme but gave RMT a high priority. Most mornings she did them after the roll call, similarly to Gwen.

Five, we definitely do it every day. Sometimes it might depend on (whole school activity) and things, we might just do one, backslides and one other (Agatha).

Term 2 was good, we would have done them three or four times a week at least, probably the same for Term 3. And then this term (Term 4) we have done them pretty much every day. So, it's, well they kind of expect it now (Iris).

The time required to complete the movements was approximately five minutes and the teachers were able to find that amount of time in their day. No additional equipment was required, and the teachers had set their classroom spaces so there was enough room for the children to lie down on the floor. The teachers saw this 'ease of set-up' as a positive of the programme. They commented that they liked not having to use or find additional equipment and this allowed flexibility in relation to timing.

As reported in Section 4.2 (Table 4.6) a statistically significant difference ($p = 0.018$) was detected between the group that completed the movements four or more times per week and the group that completed the movements less than four times per week in relation to their reduction in reflex profile scores. Table 4.4 showed a greater reduction in the mean scores of the intervention group and the four or more times per week group at the mid-point of the research when only half the children were completing RMT. However, the reduction in reflex profile was greater at the end of the year: control went from 4.11 (2.27) to 2.24 (2.02) and the children completing RMT for four or more times per week went from 4.37 (1.93) to 1.13 (1.57). This

implies that the reduction in reflex profiles scores increases with an extended time completing RMT and with a higher frequency. Frequency and RMT issues are also reported in Chapter 5 in relation to student achievement.

4.3.4 Motivation

Motivating children to do something that is too challenging or something they don't like for some reason adds stress for a busy teacher (Farmer, 2018; Rideout & Koot, 2009). For this reason, the level of motivation towards RMT was of interest to the researcher. When asked about motivation to do the movements teachers said that they found the children were easy to motivate.

No, like they all wanted to do it. So, some of the children who joined later on in the year, they just picked them up from the other children and they just joined in (Gwen).

Really good and I just cannot believe how quickly the children have picked it up and are doing it properly, it's just amazing (Agatha).

At Pōhutukawa they had different children leading the movements, and it was viewed as a quiet moment in the day.

The children like leading that, you saw that (by) using the timer and having different children lead it. Yea, it's very normal for them to do that and it is, you talk about mindfulness and being able to just have a moment to stop, and so something that is sort of thoughtful and that has been that for us, which has been nice this year. So, I liken it to a mindful moment each day (Mildred).

Betty also used children to run the movements and a timer helped them know when to change.

I have got that wee timer and I stick it on and they do that (Betty).

Edith felt that by the end of the year the children were tired, and they needed additional monitoring.

You've still got to go around and make sure, you know at the end they were just getting a bit lazy. So, it was just more hands on. But it is very quick. Super quick (Edith).

Another aspect of motivation that was considered was that the children were given a choice as to which movement they completed. This aspect of RMT fits with the NZ Curriculum key competency of *thinking* (Ministry of Education, 2007, p. 12). Children have an opportunity to be creative, critical thinkers based on their experience and feedback about the movements from their bodies. As has been mentioned in Section 3.2, giving children choices is an aspect of the programme that sets it apart from other programmes. There is a belief (Dempsey, personal

communication, January 14, 2016) that children will choose what they need and begin where they are capable and confident. With increased skills, more challenging movements may be undertaken. Several teachers felt they wanted the class to complete all five movements, especially when there were children who could not accurately complete all the movements. At Kauri, children were able to choose the two movements they wanted to complete. However, Edith's concern was that the children were only doing the movements that they could manage easily. She made the following comments:

I don't know about (the children choosing their exercises) 'cos they were all choosing very similar ones. And it was the easy ones, the rocking, the feet, very rarely, that really hard one, the back sliding. But that would probably have been the area I thought (needed because) they couldn't do it properly. But they never picked it because it was the hardest (Edith).

Another teacher was concerned that children with lower levels of physical skills would find the movements hard.

I think the only other thing that comes across is that, in terms of kid's motor skills, or their actual ability to successfully, or accurately do the movement. Like some kids, they are not so limber, so they can't get their knees to the floor to do the window wiper thing, or especially the one where they are laying on the back with our feet up (back slides). That in itself is a technique that they just need to, you almost need to take a group aside and say, "Ok we are going to just practise" (Stanley).

Stanley's children were in the class that completed the movements for the shortest time. They did not reach a stage where they had learned all the movements and were then able to choose their preferred movement.

Parent comments about motivation. Parent perspectives have been valued as part of this research as they may see aspects of their children's development that a teacher may not be aware of. Parents were asked if their children had said anything about the movements at home. Of the 26 parents interviewed, 25 parents made comments that their children liked the movements or they said the children had not commented. The parents felt that the lack of comment was positive as they would have been told if the movements were "really horrible". They felt that their children just viewed RMT as a normal part of the programme. Kelly asked her daughter about her thoughts on the movements on the morning of the interview:

I actually asked her about that this morning and she sort of told me that she's been doing stuff, exercises and that she had been enjoying them (Kelly).

Kelly also said that her daughter did not really like the test where the pen ran down her back, but otherwise, she enjoyed them. Sally's daughter liked the process of the implementation of the movements, as she felt she was able to achieve something with minimal pressure.

She likes the movements, I think it is something that is reachable for her and it is in an environment, or I think the aspect of wanting her to achieve or accomplish it, I think that is not as heavily weighed on, it is more of the environment of how it is presented as well. Although it is not as demanding – “we have to do it”. So that in itself, I think she enjoys. She doesn't have that pressure on her to be able to conform and do what everyone else does (Sally).

Alex's son liked the movements so much that he did them at home as well. He had also picked up some reasons why he was doing the movements. He was very interested in improving his sporting ability.

He does them at home. This is what we do. He lies down, "this helps with my hips" and "this helps with this". Yeah. He is quite a fit, active boy (Alex).

Another child completed the movements at home once. Jane made the following observation:

I was doing some yoga at home, and you know I got out a mat for her, and I said "Oh you can join in" and she said, "I can do my exercises from school". So, she had a wee go at them (Jane).

Kay's son was in the single classroom where half the children were completing the movements and the others were not. He could not understand why some children were doing the movements and some were not, and he complained about them. This was the only negative comment about the movements from the 26 parents interviewed.

At the start, he complained a few times (after having to do the movements) and asked why he had to do it. It seemed to be a problem that some students did and some didn't have to participate - it was hard to explain to him the concept of opting out etc. But he must have become so used to it that this wore off after the first few times! (Kay).

4.3.5 Timing

Teachers managed the timing of the movements within the existing routine of the classroom. They were all shown the movements and then they were left to establish their own routine. Teachers experimented with various times and ways of completing the movements to establish what was most beneficial for them and their children. Betty and Edith at Kauri were in a 69-child class and they tried different approaches but settled on doing them as individual groups during the second phase.

You know for a while we got together, and it was crazy. Even tried it outside, but it is not very comfortable (Betty).

They also worked out that for their children, first thing in the morning did not work as well.

Most of them are pretty good, especially when you go and praise them. But there are always a few that are a bit non-compliant because if you do it first thing in the morning they are a bit ratty. You know they have come in from issues at home and yeah, so sometimes it is not the best time to do it (Betty).

Iris and Mildred at Pōhutukawa also tried different times of the day. They also found that first thing in the morning did not suit their children:

At some stages, it was a particular time of the day, and then other times we have just fitted it around the programme (Mildred).

Towards the end of the year, they had established that after lunch was the best time for the children and the teachers. The children completed their movements and then went straight on to their mathematics. It was interesting to note that the daily routine at Pōhutukawa was different from traditional school routines in New Zealand. The lower decile school made a conscious effort to meet the needs of the children. Children were sent to play after being in class, and then they sat down to eat – traditionally in New Zealand children eat and then play. This research was not focused on school routines, but Pōhutukawa's approach was noted as it aligned with their approach to finding the best time for the RMT movements. Other teachers timed the movements with the roll or an activity at the beginning of the day, but Pōhutukawa, through experimentation, established their 'after lunch' routine. This progresses the idea that placement of RMT is flexible and can meet the needs of the group.

4.3.6 Focus

The ability of children to maintain attention or focus is known to improve their academic outcomes (Ogg, Volpe, & Rogers, 2016). When children are focused they learn more effectively and the teachers commented on this in relation to the use of RMT in the classroom. Agatha noticed the difference in days when she had not completed the movements with her five-year-olds.

The focus changed for the children having started the movements. I noticed when we hadn't done them sometimes, I certainly noticed a difference straight away, that they just could not concentrate, rolling around on the floor but as soon as I thought "Oh, right let's do our exercises", there would be a completely different tone. The children were very engaged in their learning and were able to hold their focus for longer periods of time (Agatha).

Iris also noticed that the movements were able to settle the children after lunch.

It does settle them a lot, so after the exercises, they settle down and they are ready to learn which is lovely (Iris).

This noticing of an increase in the children's ability to focus has potential to change the rate of skill development in areas that are not considered in this research.

The researcher noticed that children were not able to maintain the rhythm of the movements initially. This may have been an indication of an inability to focus on both the movements and keeping the rhythm. Rhythm has been identified as an important aspect of development (Hannon & Trehub, 2005; Phillips-Silver, 2009; Thelen, 1981) and it was noticed over the year that the children's ability to maintain the rhythm improved. Children's musical skills were not assessed, but it is an area that would be interesting for further research. Collins (2014) completed research into music education and brain development. Positive development was observed in musicians who had weekly instrument lessons for two or more years. Did these musicians have any retained primitive reflexes and how would their music experience change if the reflex issues were addressed? This would have implications for music teachers when they have children who are challenged by the physical skills associated with learning an instrument, as well as children who do not have the ability to maintain a beat.

4.3.7 Discussion

The findings and results in this research, in relation to RMT in the classroom, support Bronfenbrenner's (2005; Rosa & Tudge, 2013) bio-ecological theory. His process-person-context-time (PPCT) theory can be applied to primitive reflexes and RMT, with links to proximal processes, as the regular progression of interactions between the individual and the objects and symbols within their immediate environment (Rosa & Tudge, 2013). A child's primitive reflexes progress typically when the environment is conducive to such progression and within Bronfenbrenner's model, they would be considered a proximal process. The level of primitive reflex integration was tested in this research. The child's trip or lack of it down the birth canal and the child's movement opportunities after birth are considered part of the processes that allow the primitive reflexes to integrate. However, as described previously, a

child's exposure to stress factors before and after birth can lead to an interruption of the primitive reflex integration process, thus viewed as part of a proximal process.

The 'person' aspect of the model relates to the child's characteristics that influence how they interact with the proximal processes. In drawing on the hermeneutic tradition, several questions can be raised: does the child engage in and initiate physical activity that facilitates primitive reflex integration, or do they lie passively? Are they distracted easily, or do they become frustrated? These 'person' characteristics could determine the developmental outcomes and provide some explanation as to why two children with similar environments might have different developmental outcomes.

The 'context' aspect of Bronfenbrenner's theory relates to the interactions of the microsystems (termed mesosystem), the exosystem (systems that influence the child but there is no direct contact) and the macrosystem (culture and values) (Rosa & Tudge, 2013). In relation to primitive reflex integration, the context can be seen as the stress in a family that may impact the child, the amount of time and space given to the child to move (Thelen, 1981) and the importance placed on recognising the issue of retained primitive reflexes in underachieving, behaviourally challenged children. Based on further research, RMT could be viewed as an opportunity to change the developmental path of children with retained reflexes. Finally, the 'time' aspect of Bronfenbrenner's theory relates to the historical period in which the child lives (Bronfenbrenner, 2005). Accepted styles of parenting and access to resources would fit this aspect, but as already discussed, the Canterbury earthquakes and their impact on families made this a significant 'time' in these children's lives. Bronfenbrenner believed that development was influenced by the child and its interaction with the environment, with a secure, higher socio-economic background providing greater opportunity for the proximal processes to support development.

A pragmatic approach enables Bronfenbrenner's PPCT theory to be explored more extensively. While quantitative data would give an indication as to how the child/*person* achieved within the school/*context* in relation to primitive reflex integration and the use of RMT, it is the qualitative findings that add additional meaning and depth of understanding to the theory. Quantitatively, the results show a reduction in reflex profiles when RMT is used in this generic approach four or more times per week, but these results do not indicate that the programme was easy for teachers

to use nor that the children engaged willingly. If, as Bronfenbrenner implies (Rosa & Tudge, 2013), children can influence their developmental pathway, then engagement within microsystems is important and has the opportunity to influence outcomes.

RMT was placed into the sociocultural environment of the classroom according to Vygotsky's theories (Edwards, 2017; Kozulin, 2004; Vygotsky, 1978). The programme's success depended on its ability to accommodate this style of learning and acquisition of knowledge, while being supported by Vygotsky's theory that children need to actively participate in their learning (Edwards, 2017; Vygotsky, 1978). It has been assumed that seven and eight-year-olds are unlikely to discover movements that integrate retained primitive reflexes the way an infant does (Blomberg & Dempsey, 2011). This places an importance on Vygotsky's theories around the MKO (teacher) and their knowledge about RMT and the ZPD where the teacher assists in the learning of the movements, taking children from the place where they can complete a version of the movements, to being able to complete the movements accurately. It is also possible that children learned to complete the movements more accurately from the children around them. Teachers found the movements easy to learn and they were able to pass on their knowledge to the children. The teachers were able to adapt RMT to the sociocultural learning environment.

RMT and its affinity with the NZ Curriculum (Ministry of Education, 2007) were presented (Figure 4.5). It is important that if New Zealand teachers are to consider using RMT, it needs to align with and support key competencies within the curriculum. In the literature review it was reported that teachers support the need for movement based activities in the curriculum (Dyson et al., 2018; Gehris et al., 2015; McLachlan et al., 2017; Morgan & Hansen, 2008). However teachers identified a lack of resources and confidence as reasons it was challenging for them to provide physical activity. RMT required minimal resourcing and teachers reported it was 'easy to use'. The possibility that the movements can be self-directed is an important factor in this programme. Having students take greater control of their learning is a focus of the curriculum document and RMT may be able to be used to support student learning in mathematics, health and physical education. The original aim of the research was intended to focus on the child and their outcomes. However, as data were gathered additional benefits became apparent such as supporting curriculum goals.

Number of days completing RMT. The amount of time engaged in the movements was considered as part of the research design. Through discussion with Dempsey (personal communication, January 14, 2016) it was decided that five months was a reasonable length of time to be able to see differences in children's behaviour and achievement. As no research focused on the effectiveness of RMT was found this was an estimate. The results show there was an improvement in mean scores of the reflex profiles after 94 days, but greater improvements were observed after 216 days. Similar research in this area was conducted for nine months (Grzywniak, 2017), one year (Brown, 2010; Goddard-Blythe, 2012; McPhillips et al., 2000) and two years (Jordan-Black, 2005) with participants completing the movements five times each week. The results in this research support their findings that there were significant differences between intervention and control groups after one year. In this research, a statistically significant difference between the groups after 94 days was not detected but statistically significant difference was detected between the four or more times per week and less than four times per week groups at the end of the research. This indicates that when using RMT in a generic way, one year using the movements is associated with greater change. It is acknowledged that having the control group begin the movements after 94 days may have in fact reduced the differences between the groups. However, this advances knowledge around frequency and length of time needed to complete the generic use of RMT.

The differences between the structures of the classrooms presented challenges for teachers in implementing RMT with the divided groups. Dividing the groups was viewed as essential to ensure the reliability of the results. In studies where different classrooms were compared (Brown, 2010; Reynolds et al., 2003) there has been criticism that the positive results could be attributed to different teaching quality and styles (McPhillips, 2003; Richards et al., 2003; Singleton & Stuart, 2003; Whiteley & Pope, 2003). The classrooms in this research were divided into two groups, control and intervention, and the possible 'teacher effect' was reduced. However, as will be shown in the next section, this approach was challenging for teachers, especially in the 69-child classroom. Negotiating times with other teachers had to be managed, and there was an increased waiting time for groups to join together. This is a factor associated with the New Zealand Government's move towards Innovative Learning Environments (ILE) (Ministry of Education, n.d.) (described in Section 3.4) and the challenges associated with these

classrooms. The teachers worked around the issues knowing the divided groups were required for a finite time and increased the validity of the research.

Frequency and Motivation. Using RMT within a classroom setting is the focus of this section. It addresses aspects of the over-riding research question relating to the influence RMT has in the classroom and how it fits within the curriculum and the physical constraints of the classroom. As noted in Chapter 2 and above, Bronfenbrenner's (1997; Rosa & Tudge, 2013) process-person-context-time theory discusses the influences the child and the immediate environment have on their development. Giving a child an opportunity to change the level of retained primitive reflexes they are experiencing could be seen to change the child's developmental path by increasing their levels of maturation through primitive reflex integration. Using Bronfenbrenner's theory that links the environment and a child's development (Rosa & Tudge, 2013), this research places a high value on the ease with which RMT can be placed in the child's environment: their microsystem. The importance of the teacher's role is also highlighted when the context includes the school. In this research, the teacher's relationship with RMT and the implementation of the programme for the child becomes part of the child's mesosystem: two microsystems interacting with each other. If RMT was challenging to implement within the classroom then the opportunity for the children to affect their development might be lost. Teacher engagement with the programme was reflected in the reflex profile results, again reinforcing the link between microsystems and mesosystems and their impact on the child's development. When applying Vygotskian theory (Kozulin, 2004; Schneider & Watkins, 1996; Vygotsky, 1978) to teacher involvement, the teacher is assessing the 'zone of proximal development' determining the level at which the child can solve the RMT decision of which movement they use and in what order, while providing adult support. Vygotsky believed that the child could achieve greater success with the right level of adult guidance, peer collaboration and independence. RMT offers opportunities for independent decision-making thus supporting social and emotional skills.

In this research, teachers found RMT easy to use. They set their classrooms so there was space for the children to complete the movements and the amount of time required each day was manageable within the curriculum. These aspects are crucial when teachers are considering using

movement programmes. However, the space in all classrooms was limited and children needed to negotiate their space in relation to others, be considerate of others and understand that there was no competitive element in these movements. In the New Zealand (NZ) Curriculum (Ministry of Education, 2007) the key competency being addressed is *relating to others*. Students also saw teachers testing alternatives, such as completing the movements outside and acting on the feedback which is a component of this competency. When equipment and additional resources are required for daily movements, the set-up time and pack-up time needs to be factored in.

Many schools offer PMP programmes as described in Chapter 2, but they are often only offered in the winter terms. Like eating vegetables and doing music practices, a daily dose of RMT is more likely to be effective than spasmodic programmes run at certain times of the year (e.g. for two winter terms) (Klomp, 2012). The Australian UP programme (Williams, 2015) described in Section 2.2, completed on a daily basis, was one programme that showed positive student achievement results. As is shown in this research, with a small amount of time required, once a day, it is possible that RMT would have a higher chance of being completed daily. One teacher, Agatha, managed to complete some RMT each school day, while three others managed four to five days a week and two teachers managed three to four times per week. This frequency of the movements would seem to be an essential part of the success and the statistically significant difference between the groups that reportedly completed the movement four to five times per week when compared to those that reported completing them three to four times per week was noticed. A meta-analysis of massed versus distributed practise as described by Donovan and Radosevich (1999), found that distributed practise achieved statistically higher levels of motor skill acquisition and retention, with an overall effect size of 0.46. They stressed that the type and complexity of the activity determined how far apart the practices should be spaced. Küpper-Tetzel's (2014) analysis of distributed practise research found multiple, distributed practices a useful approach within the classroom, especially for cognitive tasks such as mathematics and science, although she stressed that there is not a full understanding of how and why this practice method is successful. When the children in this research used RMT for distributed practices of five minutes per day, four to five times per week it was associated with lowered reflex profiles thus indicating that regular, distributed practice of RMT is associated with increased primitive reflex integration. This research has not assessed how or why this happens but it supports

research conducted by McPhillips et.al. (2000) and Goddard-Blythe (2012) using primitive reflex integration programmes for five days a week.

While the feedback from teachers obtained about the programme was mostly positive, setting the programme up within the classroom routine did take some time and it is possible that this could have impacted the results of the first phase, control/intervention. Previous experience to guide teachers was minimal and they had to establish the routine of using RMT themselves. This appears to have taken some time, and it became clear that during the second part of the year RMT management was easier. Another factor was that teachers had minimal training in the information underlying the use of RMT and the issue of primitive reflex integration. This was a deliberate action so that their knowledge would be less likely to influence their use of the movements and what they said to the children. Gazca's research (2012) found that with a greater understanding of the reflex integration issues and the implications, teachers had increased commitment to the movements. Agatha had expressed interest in RMT and had asked to use the movements in her class. She engaged the researcher in conversations about how the movements worked and how to manage them with the group. The number of times she used the movements each week (four or more) showed a high level of commitment to the programme. Her perception was that the student results were higher when RMT was used. This has implications for teacher education in relation to the use of RMT. If teachers understand the reflex processes and the signs of reflex integration as well as knowing about possible solutions it is more likely that they may engage in the programme.

The engagement of children completing RMT was observed by teachers and the researcher. Teachers commented that children were generally easy to motivate to complete the movements. Bronfenbrenner believes that a child can influence their development (Rosa & Tudge, 2013) through his person-process-context-time (PPCT) theory and this will be more likely to happen if the child is easily engaged in a process that may facilitate development. If teachers see the engagement of the 'person with the process' then they are more likely to provide 'context' by allocating classroom time. The researcher noticed a few children who physically struggled to complete the movements, but with help from an adult and some adaptation, success was achieved within the child's ability range. This flexibility of the 'process' and the lack of a competitive

element in the movements were seen by the teachers as strengths. There are many opportunities at school for children to compete (e.g., sports competitions) and competition adds additional stress and changes how the child completes an activity. The teachers liked the fact that each child was able to complete the movements as an individual in a relaxed manner. Having each child work at their own level and with an element of choice, fits with the child-centred learning philosophy of the New Zealand Curriculum; life-long learners who are actively involved in their learning (Ministry of Education, 2007). The parents' comments about motivation also support the high levels of engagement. RMT fits within Bronfenbrenner's PPCT theory when the motivation of the learner within their environment is considered. Goddard-Blythe (2012) believes that retained reflexes can be integrated through movement and she has shown a reduction in learning difficulties through this process. When Bronfenbrenner's PPCT theory is combined with Goddard's findings, the RMT programme gives rise to the possibility that children with retained reflexes may be able to alter their developmental path.

In relation to children's motivation and engagement, Vygotsky's theories (as discussed in Section 2.6) relating to the MKO and ZPD were evident (Daniels, 2017; Vygotsky, 1978; Wertsch, 1985). Children needed the skills of the MKO to learn and manage the task, and they were able to participate in their learning of the movements as well as observing others completing the movements. Vygotsky viewed the social context of learning as paramount and RMT was shown to be used successfully in the sociocultural environment.

The generic implementation of the RMT movements within the classroom for this research is a possible limitation. For some children, the chosen movements will have enabled greater integration and for others, there may be limited or no benefit. Choosing four movements from a possible 17 was problematic and it is possible that for some children the correct movements were not offered. Teacher workloads and the unproven nature of RMT were the basis for limiting the movements offered. This is something future research could investigate. The RMT programme is typically used in individualised therapeutic settings that can respond to individual needs (personal communication, Blomberg, Dempsey, July 2018), however, this research was focused on the effect of generalising the programme to a wider group. Another factor for consideration was differences between approaches; allowing children to choose their movements and the

teacher prescribing movements was not measured but is another area for possible research. It may be possible that to meet teacher desire to choose the movements, along with children being allowed to choose their preferred movement by mixing teacher and child chosen movements. This approach would ensure children had opportunities to experience all the movements on offer, but also have time to engage in their preferred movement.

Timing. Another strength of the RMT programme observed in this research was the flexibility with which it could be completed. Teachers could fit RMT around their programme and what they believed worked best for their children. Two teachers in high SES schools completed the movements at the beginning of the day after the roll had been called. The middle SES school completed the movements during the morning and the low SES school completed them in the afternoon. It seemed that the lower SES children needed more time to settle into the day before the teachers believed it was beneficial to complete the RMT. This could relate to the complexities of their lives outside the classroom, and the stresses at home, although this was not investigated, and neither was it a focus of this research.

Involving the children in the management of the movements was viewed positively by teachers. Agatha, Betty and Mildred all used children to manage the timing. This aligns with the key competencies in the NZ Curriculum (Ministry of Education, 2007) relating to *participating, contributing and managing self*. RMT could be an additional opportunity for children to experience leadership opportunities when engaged in this classroom activity. Gwen allowed her children to choose two movements every day while Agatha, Betty and Mildred allowed a degree of choice; sometimes they chose and sometimes the children chose. This flexibility is seen as a strength when child-centred learning is a focus and allows teachers to meet the needs of their children, while also giving the children some ownership relating to the movements they choose. It also aligns with the key competency *managing self* (Ministry of Education, 2007), children being offered an opportunity to manage their own movements and make plans as to which movements they will complete: “Do I feel like challenging myself with a harder movement? Or “Today I need to take it easy!” Dempsey (personal communication, January 14, 2016) believes that children will choose the movement they need and will complete the amounts they need. This approach aligns with constructivist theories as described by Hmelo-Silver, Duncan and Chinn

(2007), where children construct their own knowledge. With RMT, children can adjust the movements based on preferences. RMT also allows for inquiry-learning (IL). Students engage in experiences to increase their understanding and there is some form of scaffolding provided by adults. Scaffolding involves making learning accessible to learners by presenting manageable tasks appropriate to the student's stage of skill development. Hmelo-Silver et al. (2007) believe that this approach to learning has greater opportunities for student engagement. Vygotsky also believed that children constructed their own knowledge through social interaction (Vygotsky, 1978) and with assistance from more-skilled individuals. RMT can be taught and experienced one movement at a time and there is no prescribed order or form. Agatha and Edith commented that they preferred to choose the movements as they felt that the children were choosing easy movements and avoiding the harder ones, and possibly the ones they needed most. The teachers would be able to make this approach work as well. However, Dempsey (personal communication, January 14, 2016) believes that it is acceptable for the children to complete the easy ones if that is what they feel like doing. Further research comparing children who completed a chosen set of movements and children who were free to choose would be needed to verify these comments and perceptions.

Focus. Research focused on children's ability to maintain attention in their learning environment links engagement, motivation and interpersonal skills, known as academic enablers, with student achievement (Ogg et al., 2016). Ogg et al. found that children who were inattentive were more likely to have lower levels of achievement in literacy than children who were motivated and engaged in their learning. Children with ADD and ADHD inattention can display a lack of motivation and engagement as noticed by teachers (Mather & Morris, 2008; Ogg et al., 2016). The teachers in this research noticed that when the children were using RMT there was an increase in the children's level of focus and attention. Agatha noticed a marked difference in focus levels between days when the movements were completed and days when they were not. Iris also noticed that the movements calmed the children and enabled them to be ready for learning. When children are able to focus on tasks there was higher engagement and greater progress achieved (Dehn, 2008) which could apply across all areas of the curriculum. It is possible that some of the improved results described in Chapter 5 are due to the increase in children's ability to focus on the task. Taking time to relax, as in mindfulness, has been shown to

increase children's ability to focus and reduce their stress (Costello & Lawler, 2014). The quietness associated with completing the movements along with their repetitive nature may be part of the reason why teachers reported increased focus and calm in the children. If RMT can aid children's focus and attention there is value spending five minutes each day completing the movements.

4.4 Summary of Chapter 4

The pragmatic paradigm used in this research has allowed the 'whole child' to remain in focus for the reporting of the findings and results. This approach progresses information about the possible outcomes of reflex integration programmes. The results show that reflexes integrated while children were using RMT, but rich insights were gained through exploration of how the programme was managed in the physical classroom, which areas of the curriculum it facilitated and how teachers and student's engaged with the movements. The convergent design of the research allowed the data to be gathered throughout the year, with insights gained through the teaching of the movements, the testing of the children and the monitoring phase of movement usage in the classroom. RMT has been considered a phenomenon and exploring it's usage within its natural environment means these findings and results have practical implications for teachers. There was a researcher expectation that RMT was manageable with a group of children, but each teacher made different observations, thus progressing what is known about implementing RMT in a classroom. There was a mix of approaches in relation to child-directed choosing of movements. The hermeneutic circles allowed the data to be revisited and greater insight gained.

The findings and results progress the idea that RMT is easy to use in the classroom and is flexible within the school programme. This has the possibility of increasing the likelihood that teachers may incorporate the movements into their programme. Reflex profiles of the children using RMT four or more times each week were significantly lower than children using RMT fewer than four times each week indicating that a higher engagement with RMT increased the integration of the retained primitive reflexes. The qualitative data supports the ease with which RMT can be used and the quantitative data provides reflex profile results that show greater primitive reflex integration after using RMT. However, these results were obtained by using four of a possible 17 movements, and without using possible progressions such as vision training. It

has been noted that this reduced selection may have influenced the results because some children may not have had access to the movements they required.

The outcomes of RMT aligns with key competencies in the NZ Curriculum (Ministry of Education, 2007) namely *managing self, relating to others, participating and contributing*. This extends existing information. RMT also fitted within physical education and mathematics competencies of the NZ Curriculum. While the time spent each day on RMT was relatively small, it seems that regularity is an important factor. This aligns RMT with what is known about distributed practise theory (Donovan & Radosevich, 1999; Küpper-Tetzel, 2014). Boys are slightly more likely to have retained primitive reflexes, and for this research, the SES of a child did not correlate with reflex retention. In line with Bronfenbrenner's PPCT theory suggesting that the child and their surrounding systems influence development, it is possible that reducing the child's reflex profile may affect their developmental pathway. Linking Bronfenbrenner's theories and RMT progresses the idea that RMT could be positioned within a microsystem thus having the ability to influence development. The self-management aspect of RMT and links to Vygotsky's theories progress the notion that it is possible to allow children some self-direction in a reflex integration programme. This element is not documented in other reflex integration research and advances understanding in areas associated with self-management and reflex integration programmes.

Chapter 5 focuses on achievement and behavioural outcomes of the research participants. Is it possible that using RMT can affect reading, writing, mathematics scores as well neurological development as measured by the Draw-A-Person and behaviour as measured by the Strengths and Difficulties questionnaire? New Zealand teachers have indicated that they prefer 'whole-class' interventions for the management of behaviour (Rideout & Koot, 2009) and the next section adds to this information.

Chapter 5 Student Achievement and Behaviour: Findings, Results and Discussion

This is the second chapter combining findings, results and discussion. The first part of the chapter focuses on student achievement. As described in Section 3.3, reading, writing and mathematics assessments were collated and the Draw-A-Person test was used as an indicator of neurological change. Parents also made comments about changes they noticed at home in relation to the academic and sporting achievement of their children.

The research question addressed by the first section is:

- *What influence does participation in an RMT programme have on **student achievement**: reading, writing and mathematics?*

Qualitative data are recorded first, followed by the quantitative results. Finally, a discussion on student achievement draws the findings and results together in each section.

The second part of the chapter focuses on the social and emotional changes of the participants. Vygotsky believed that social and emotional development are key components in the progression of a child's overall development (Vygotsky, 1978). This second section examines the research question:

- *What influence does participation in an RMT programme have on **student behaviour**: social and emotional?*

5.1 Student Achievement: Findings and Results

Qualitative and quantitative data were gathered throughout the research process relating to student achievement. The range of tests and data gathered were intended to reflect the complexity of retained primitive reflexes, assuming that children's rates and area of change are highly individualised. Integrating primitive reflexes in one child may influence their reading development (McPhillips & Jordan-Black, 2007b). For a second child, where the same movements were completed, it is possible their reading was already progressing, but social interactions were challenging. Establishing friendships for the second child might be a significant development (Blomberg & Dempsey, 2011). However, in schools, teachers and policymakers are interested in student achievement thus this section addresses this aspect of development. Student achievement is reported first followed by student behaviour. In both sections the findings and results are reported separately with a combined discussion following. As already discussed in Sections 3.3 and 3.4, the discussions follow a hermeneutic tradition.

5.1.1 Findings

Qualitative data for this research was gathered over 11 months. The researcher was in contact with all participant teachers throughout the research process using field notes and interviews to gather insights into student achievement. Parents provided additional perspectives. As described in Chapter 3, this data was analysed with NVivo 11 (QRS International, 2015). Field notes document teachers being enthusiastic about the commencement of the movements. At the mid-point, there were guarded positive comments about student progress after completing testing in preparation for parent-teacher interviews. The only teacher who was enthusiastic about her children's progress was Betty from Kauri School. She commented that at the mid-year parent/teacher interviews she believed she had said to more than the normal number of parents that "Your child has discovered that he/she is a learner". Her impression was that this was not something she said very often in the middle of the year, but it was more common at the end of the school year. She also noted that there had been a marked improvement in the writing of the children. Betty's children were in the 69-child class, and her whole class had been completing the movements. The other two teachers at Kauri said that things were "OK", but they did not give specific examples of improvements they had noticed the way Betty had. Gwen, from Nikau,

was observed in the middle of the year talking with a child as she marked his work. She made the following comment:

Now (child) we need to spend some time working on your focus so that your work is easier for you to do. Are you doing Tessa's exercises? (Child replied "No").
Hmm, that is interesting. (Teacher looked at me with an expression of puzzlement and interest, and then smiled) (Gwen).

It appeared that Gwen had connected an increase in children's focus with the children who were doing the movements and this child, who needed to focus more, was not in the intervention group.

The tone of the teachers' comments was noticeably different at the end of the year. Some noted that there had been some challenges within their classes. Betty made comments about the year and how it had been for the teachers, but her general feeling was that she was pleased with the results, although she acknowledged the high emotional and social needs of her group.

We have got quite a few toileting issues and I have, (in my class) got behaviour and learning issues and we have got another boy that had time at a children's home 'cos he's got family relationship issues. But the collaboration has worked really well. It has been a long year. This term has been crazy. I have never had a term like it. We seem to have been testing furiously. So, but you know, you look back at their testing and we have done a lot of good teaching and learning, and the results have really spoken for themselves (Betty).

Mildred acknowledged that the group of children were doing well at the start of the year, but she noted some observable changes in individual children.

I can see the key competencies have increased, amazingly. Across the curriculum, we started out within (the class) two-thirds of the children, at and above in all subjects, so they were higher than a standard mix of children. But they are on track and continuing with that... They are just really confident in the things that they like to do. Which is lovely. I mean this child (pointing to video of a child dancing) was completely shut down at the beginning of the year, quiet, and very anxious all the time when she first started school and now, this year, because she's able to be herself in the thing that she is extremely good at, and that confidence filters into other areas of the curriculum and she's just happy (Mildred).

Iris commented on the improved confidence that children had displayed, and she believed this increase impacted their academic achievement.

Just their confidence in themselves and being around other people. There were a lot of children that were not like that at the start of the year. So, we are writing reports for all of our Year 4's and anniversary and interims for all the other children. From where we started we have got one child that was reading a level 4 at the start of the year who has shot up to level 14 reading. Maths we started at stage 2 and now the

lowest we have got is stage 4. What they are doing is amazing. Mildred takes the high readers, she's got more at level 29 and 30 than we have below that which is wonderful, everyone has improved out of this world, it is just wonderful to see the results, and it is just lovely.

Researcher: And how does that compare to other years?

I have not seen such big jumps in children's achievement until this year. So yeah it is lovely, lovely to see. (Iris)

Iris's comment about the comparison of years was also of interest, but it needs to be acknowledged that the programme they were offering was different to last year; more child-centred learning and flexibility within the environment. However, Gwen had not had such dramatic changes to her programme and her comments were similar to Iris's. When asked about the children's results in general Gwen had this to say:

Very well academically, yes, they have all made some large gains. My special needs student, in particular, has made astounding progress. But they have all made some gains. Even kids, with behavioural needs. They have still managed to make some gains. Some children have jumped three stanines (Gwen).

Gwen's reference to 'stanines' is part of the Progressive Achievement Tests that are used in New Zealand schools (New Zealand Council for Education Research (NZCER), 2018). Test scores are converted to a scaled score and these scores are divided into nine levels of achievement within the year group. Moving three stanines in a year would be considered an excellent achievement result.

Stanley's completion of the movements with his group was limited. As reported in Section 4.4, Stanley's group was initially in the control and then due to ill health and a death, his group only established the movement routine for five weeks. His response to their achievement over the year was guarded and spoken in a cautious, carefully worded manner.

Everything, ok (pause), I think when I came into this room the kids seemed very unsettled. And now they seem a lot surer of themselves, both academically and socially. Although they are not exactly where I would want them to be, they have improved. There seems to be, particularly kids that don't know how to manage themselves or socially know how best to interact with others (Stanley).

Parent comments. Parents made favourable comments about their children's progress. Two parents commented that their child had not had a very good year. One child was the youngest in the class and the other was struggling socially. The parent believed her child's dislike of school was impacting on her academic work. However, other parents had noticed good gains in their children's academic progress, particularly in reading. Specific comments from parents are presented in the reading observations in Section 5.1.4

5.1.2 Assessment - Results

Assessing student achievement is used in quantitative research. Standardised testing is preferred as it provides the most reliable statistical information on which to establish evidence-based interventions (Braden & Shernoff, 2008). In this research, information relating to four areas of achievement were gathered: 1: neurological change, 2: reading, 3: writing, and 4: mathematics. The researcher was mindful of the testing regime within the New Zealand school system (children are tested at least three times each year for reading, writing, mathematics and spelling), and to ensure the children were not 'over tested', achievement results from the teachers were used. An assumption was made that because all the schools were part of the NZ National Standards assessment system, as described in Chapter 3, the results would be able to be analysed statistically. The schools were all able to report their results in a uniform way, reading levels, mathematics levels and stages, and writing levels. However, two difficulties arose: firstly, the assessments were standards-based with Overall Teacher Judgement (OTJ) as a key component and this means that what is being assessed changes as the child progresses; and secondly, the steps indicated in the reading and mathematics levels were not linear. Writing was an area where there appeared to be a linear progression of three steps each year.

As reported in Section 3.4 participants were assigned an average level of frequency as reported by teachers. At time 0 control participants were excluded so that frequency scores reflected the RMT effect. Control participants were given a frequency score when they began the movements.

5.1.3 Draw-A-Person (DAP)

The DAP test was used in this research to assess neurological change. The test has been described in detail in Chapter 3. An established understanding of their body occurs alongside

improved motor skills, which according to Thelen (1981; Thelen & Corbetta, 1996) and Williams (2015) prepares children for academic learning. Neurological change can be expected to happen when there are achievement changes. This test was viewed as part of the triangulation of results.

DAP: Findings. Parents and teachers were not asked to comment on the DAP pictures, but the researcher made some observations. The first time the test was taken the children were very excited and keen to participate, the second time they were also willing to draw. However, it was noticed that for the third test some children were tired, and it was more of an effort. This final test was taken during the last few weeks of the school year when the classroom routines were replaced with outings and end-of-year activities. This may have influenced some results and it is possible that this test should have been completed one month earlier. Some children made comments like “Oh not this again”. It appeared that there was some ‘test fatigue’ with the third repetition.

Changes were noticed in the drawings. Some increased in size while others decreased. With many of the drawings that decreased, there was an increase in detail and maturity in the drawing. Figures 5.1 to 5.4 show examples of changes noticed in children’s drawings. Of interest were drawings that were almost identical throughout the year. Two of these are in Figure 5.1. Both children were in Kauri 3 where RMT was used for a short time and for less than four days per week. The drawings remained the same size and the details included were similar. Student 90’s drawings changed very little. There was one addition to the clothing, fingers were similar, but the feet had shoelaces by the third drawing. Student 86 added fingers to the last drawing and changed the positioning of the legs, but again the drawings are very similar.







		
Beginning Drawing Student 90. group.	Middle Drawing Student 90. Control group.	End Drawing Student 90. Control group – movements completed for 5 weeks 3 times per week.
		
Beginning Drawing Student 86. Control group.	Middle Drawing Student 86. Control group.	End Drawing Student 86. Control group – movements completed for 5 weeks 3 times per week.

Figure 5.1. Student drawings from the <4 times per week group.

Another child, Student 167, who was in the control group drew an almost identical drawing from the first assessment to the second as is shown in Figure 5.2. The child then began the RMT movements four or more times each week and the drawing changed noticeably: hands, feet and items of clothing were added; and proportions were more accurate indicating an increased awareness and perception of his body. However, the size of the drawings remained similar throughout the year.


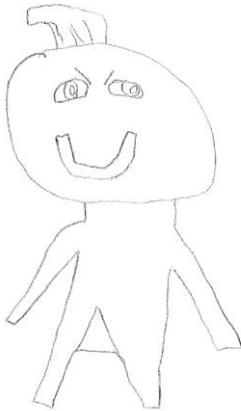

		
Beginning Drawing Student 167. Control group.	Middle Drawing Student 167. Control group.	End Drawing Student 167. Control group – movements completed for 20 weeks 4-5 times per week.

Figure 5.2. Student 167's progression of drawings from beginning to end.

Student 31 was an example where extensive changes in her drawings were observed (Figure 5.3). The first drawing is a very immature stick figure drawing, and the final drawing has two-dimensional arms and legs, with a neck and waist. The mother of this child was one of the parents interviewed and she commented on the many changes her daughter had made in reading, writing, sports endeavours and social connectedness.




		
Beginning Drawing Student 31. Intervention group.	Middle Drawing Student 31. Intervention group.	End Drawing Student 31. She was in a group that completed the movements 4 – 5 times per week.

Figure 5.3. Student 31's drawings: beginning, middle and end.

The final examples of drawings are Orla's (Figure 5.4). She was a student with identified learning challenges at Nikau School. She had been allocated some learning support, but not a full school day. Orla was in the intervention group and appeared to like individualised contact with the researcher. She would do the movements when the researcher was in the room which was eight times during the first 94 days, but she would not do them when the researcher was not there. She preferred to stay with the control children. The first drawing was completed reluctantly and she refused to draw herself. Instead, she chose to draw the teacher's dog. When the time came for the second drawing, she refused. Another attempt was made a few days later with the same response. At the end of the year she was willingly completing the movements as it was a 'whole class' activity. When asked to complete the drawing she said "Sure" and then quickly drew the drawing in Figure 5.4. She drew an even better one the following day but would not allow it to be used. While it is not clear what made these changes for Orla, she was completing RMT when there was a noticeable change in her academic skills, her social skills and her behaviour. Her writing changes are illustrated in the Section 5.1.



	Refused to draw at the mid-point	
Beginning Drawing Orla. Intervention group although she refused to do the movements.	Middle Drawing Orla. Intervention group. She started the movements when the whole class was involved.	End Drawing Orla. She was in a group that completed the movements 4 – 5 times per week.

Figure 5.4. Orla DAP drawings.

DAP: Results. DAP assessment procedures were described in Chapter 3. The mean scores in Table 5.1 show overall increases in the DAP scores across the control (19.93 (5.70) to 25.00 (6.04)) and the intervention group (18.87 (6.82) to 26.04 (8.03)) indicating greater improvements

for the intervention group. Scores were similar when the frequency was factored in. The group using RMT less than four times per week went from 19.08 (4.14) to 24.72 (7.21) and the group using RMT more than four times per week went from 21.11 (6.85) to 26.42 (7.06).

Table 5.1. *Mean DAP Scores*

DAP	DAP Scores at Time 0			DAP Scores at Time 1			DAP Scores at Time 2		
	(Day 1)			(Mid-point Day 94)			(Completion Day 216)		
Group	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)
Control	19.93 (5.70)	19.17 (4.82)	20.77 (6.53)	23.33 (7.61)	21.63 (5.57)	25.18 (9.13)	25.00 (6.04)	23.54 (6.09)	26.95 (5.70)
Intervention	18.87 (6.82)	19.19 (7.56)	23.81 (6.13)	22.48 (6.53)	20.62 (5.94)	24.35 (6.66)	26.04 (8.03)	23.58 (8.50)	28.50 (7.36)
<4/week	19.08 (4.14)	19.11 (5.17)	19.06 (6.9)	21.99 (7.56)	20.09 (5.87)	23.83 (8.58)	24.72 (7.21)	23.32 (7.50)	25.82 (6.91)
>=4/week	20.11 (6.85)	19.33 (8.69)	21.08 (4.14)	25.22 (4.79)	23.47 (4.75)	27.42 (4.01)	26.42 (7.06)	23.75 (8.04)	30.15 (5.50)

Note. M = Mean SD = Standard Deviation

The scores of 18.87, 19.93 and 20.11 at the beginning equates to the mental age of 7 yrs 8 mths, 7 yrs 11 mths and 8 yrs respectively. The children's chronological mean age was 6 yrs 11 months at the beginning of the year (Table 5.2). The scores of 25.00, 26.04, 24.72 and 26.42 at the end of the

Table 5.2. *DAP Scores with Age in Years and Months*

DAP with Age	Time 0	Time 1	Time 2
Control	19.93 (7 yrs, 11 mths)	23.33 (8 yrs, 9 mths)	25.00 (9 yrs, 3 mths)
Intervention	18.87 (7 yrs, 8 mths)	22.48 (8 yrs, 7 mths)	26.04 (9 yrs, 6 mths)
Frequency<4/week	19.08 (7 yrs, 9 mths)	21.99 (8 yrs, 6 mths)	24.72 (9 yrs, 2 mths)
Frequency >=4/week	20.11 (8 yrs)	25.22 (9 yrs, 3 mths)	26.42 (9 yrs, 7 mths.)

research equate to 9 yrs, 3 mths, 9yrs, 6 mths, 9yrs, and 9 yrs, 7mths (Appendix R). All groups began the year at least nine months above their chronological age and in one year the control group improved 16 months and the intervention group improved 22 months, whereas both the less than four times per week and the four or more times per week groups improved 17 months.

However, the linear mixed-effect statistical *Model 1: group* was performed on the DAP scores and detected no statistically significant difference between the two groups ($p=0.0603$) (Table 5.3). Age was not factored in the calculation as the change was of more interest to this researcher than the scores relative to children of a similar age.

Table 5.3. *Coefficient Estimates for DAP Using Model 1: Group*

DAP	<i>Estimate</i>	<i>Std - error</i>	<i>t</i>	<i>p-value</i>
Expected response for the control group at Day 0	20.39	0.92	22.10	<0.0001
Expected difference in response of the Intervention and control group at Day 0	-1.32	1.26	-1.04	0.2973
Expected effect of adding days to the control group	4.95	0.83	5.91	<0.0001
Expected difference in the effect of adding days for the Intervention and control groups	2.17	1.14	1.88	0.0603

Statistical significance was not detected when *Model 2: Frequency* was used ($p = 0.6523$) as is shown in Table 5.4.

Table 5.4. *Coefficient Estimates for DAP Using Model 2: Frequency*

DAP	<i>Estimate</i>	<i>Std - error</i>	<i>t</i>	<i>p-value</i>
Expected response for the >=4/week group at Day 0	20.00	1.11	18.01	<0.0001
Expected difference in response of the <4/week and >=4/week groups at day 0	-0.67	1.32	-.51	0.6099
Expected effect of adding days to the >=4/week group	5.83	1.04	5.60	<0.0001
Expected difference in the effect of adding days for <4/week and >=4/week groups	.65	1.44	0.45	0.6523

DAP: Discussion. Thelen (Spencer et al., 2006; Thelen, 1981; Thelen & Corbetta, 1996) attributed the neurological change in a baby, in part, to the movements they make after birth. She believed movement continued to be important in enabling children to mature both physically and neurologically. Goddard (2005, 2008, 2012; 1996), McPhillips (2014; 2000) and Blomberg and Dempsey (2011) also believe that early movements are crucial in infant development, but that these movements can be used as an intervention when retained primitive reflexes are identified in a child.

No statistically significant neurological change was observed, as measured by the DAP when the groups or frequency of the movements were factored in. However, the children in the intervention group made slightly higher gains throughout the year than the control and there was no difference between the frequency groups. Results from individual children were reported illustrating noticeable changes in some children's illustrations which were confirmed by parent comments. Physical activity has been linked with neurological development (Leisman et al., 2014; Melillo, 2011; Williams, 2015) however this research did not support that link. All teachers in the research included at least a small amount of physical activity in their daily

routine: a run around the field, or Jump Jam (Fairweather, 2018) as well as RMT. The physical activity used daily was not based on developmental needs nor was it targeting skill deficit. The aim appeared to be encouraging children move a little, and gain some fitness. While this is useful, it is not developmentally targeted movement such as RMT or Unlocking Potential programmes (Williams, 2015). The DAP test requires fine-motor skills and as will be discussed in Section 5.1.4 and 5.1.5, for some children the test may indicate their level of fine motor development rather than their neurological development. It was expected that after five months change in fine-motor skills would be evident, but it is possible that the range of movements offered in this research did not address fine-motor development for these children or it could be that these skills take longer to develop. It is possible that these children were developing gross-motor skills which were not assessed in this research.

The generic use of the RMT movements may have been a factor in the results, as well as the mixed ability of children, the SES groups and the selection of movements. In Grzywniak's (2017) research, all children had identified learning difficulties and McPhillips et al. (2000; 2007a) used participants with identified reading difficulties and low SES. Using mixed ability children in this research may have diluted the results, but the ability to have all children participate without identifying the children with difficulties is a strength of the generic approach that can be used with RMT. Also, as reported in Section 4.4, the length of time completing generic RMT movements may have been a factor. It would appear that 94 days is not long enough to see statistical differences between the groups and their DAP scores. The mean scores of the children show that many of them were functioning neurologically above their chronological age at the beginning of the research. This may have meant that there was not as much room for improvement as there may have been if the participants were selected based on learning challenges and thus immature neurological functioning.

The timing of the final test at the end of the school year may have had an impact on the results. The children were tired and there was some 'test fatigue'. The research design attempted to remove the teacher effect and necessitated the third test. This was a challenge for some children when combined with the end of year timing. These DAP results raise more questions than they answer. If an individualised programme was given to children, would DAP scores change

significantly? Also, if children with identified learning challenges and thus DAP scores lower than their chronological age were compared, would a difference be detected between the control group and the intervention group? Would extending phase one with the control and intervention groups separated have resulted in results similar to William's (2015) research in her year-long intervention? However, this change would have required a different research design. Expecting the groups to be separated for a year could have placed additional stress on teachers, making them unwilling to participate in the research and making ERHEC approval more challenging to obtain. This research progresses the understanding that when using generic RMT movements the neurological changes associated with the DAP test take longer than 94 days to show statistical significance. However, for some individuals changes were noticed implying that the set of movements chosen was appropriate for their combination or stage of reflex integration. Reading, writing and mathematics skills are the focus of the next sections.

5.1.4 Reading

Teacher and parent perceptions of reading progress are captured in this section. Comments focused on the 'feel' they had for changes and specific skill development noticed within the group of children are followed by reading score assessments.

Reading findings: Teacher comments. When teachers were asked about changes in the reading of their group of children, four teachers spoke enthusiastically about perceived changes their children had made. Betty and Edith spoke positively, and Stanley's comments were reflective of the changes he would have liked to have seen with his group of children. Mildred talked about opportunities the children had to increase vocabulary:

We have had the oral and interactive type part of literacy improve as they have more voice, and more opportunities to interact as opposed to just necessarily listening to a teacher all the time. So that has increased vocabulary really and that all plays out in literacy. I think they are doing really well. They are continuing to track above and continuing above, there is no plateauing that we are seeing at all, apart from maybe two that have learning difficulties (Mildred).

Betty noticed that many children in her group were above their expected level, particularly in reading.

We've been really good actually. The reading, in particular, I think it was about out of 70 children at least 40 (are at) gold+ which is where they need to be for Year 3 but a lot of these children are Year 2s (Betty).

Agatha was asked if she had noticed a difference in the reading progress of the children now, compared to several years in the past:

Yes, more than I am used to. I think a few years ago we started the Early Words programme, and so that's been going now for four years, running alongside our programme, but even so, I think the exercises have certainly increased their (the children's) ability to focus for longer or the way that it is all clicking, I don't know, I can't explain it, but I certainly feel there is a noticeable difference (Agatha).

She also described a graph where the progress line compared current children's reading with children from previous years.

When they came to school, sometimes they were in magenta for most of a term, but now I am finding that they are going into reds and yellows quite quickly, and they are making huge jumps. So, for instance, (this year) the range is better than the past, the range is turquoise and orange whereas here it is lots of children in the (blue and green) 20s like A (child), he went up to level 23 (Agatha).

She commented that one child went "from magenta to blue in six months" (Agatha) (Appendix Tr). This is a jump of five levels that would typically take 18 months to two years.

The overall feeling was that the reading had improved more rapidly than in other years, but all the teachers believed that it was a combination of factors that contributed to the gains. As reported in Section 3.4, one school was using a new phonics programme and another school was using inquiry-based learning. In all four school, the factors differed, with RMT being the common factor. The quantitative results are discussed below.

Reading findings: Parent comments. Parents were asked to comment on their children's reading. Reading is an activity parents often participate in at home with the three schools still sending home reading books as homework. Most of the comments talked about positive trends in reading and parents appeared to have a clear understanding of their child's reading progress. Peter, Mary and Anne's children were in the control group.

He was a little bit behind in his reading last year and he's come a long way with that this year (Mary).

J's been good, she's definitely engaged with reading and she enjoys it, I mean it's a bit of a struggle sometimes at home to consistently keep it up, but that's Ok (Peter).

I think he is a little bit below standard in some of his things, but his teacher is really happy with how his reading is going, his reading is coming up really well (Anne, child 2).

Their comments were not as enthusiastic as those from parents with children in the intervention group. The parents in the next group had children in the intervention group:

Yeah, he's definitely come up with his reading. I think he has gone up a level, in the last month or so (Jasmine).

The main thing really is his independent reading. He's doing more independent reading which is nice to see. Now he's pulling books out of his bookcase and doing his own reading (Anne, child 1)

The parents noticed changes in reading levels and an increase in independent reading as ways they measured progress. Celia described how her daughter was able to express her frustrations and say what was not working for her. "At the beginning of the year, she would just melt" (Celia). However, Celia noticed that her child's reading and spelling had improved. Felicity also noticed changes she was not expecting, and her daughter was in the intervention group:

Well, I personally believe that her reading improved about three to four months ago, whether that's due to a good relationship with (teacher) and just part of her natural development, she is definitely now absorbing even more complex words when she reads them, you can see she gets them. So, it is definitely a good transition which I am not sure I was expecting this year (Felicity).

The general feeling from the 26 parents (seven parents with children in the control group and 19 with children in the intervention group) interviewed was that their children's reading had improved.

Reading: Results. Reading tests were completed by the teachers at three points during the year: beginning, middle and end. Running-records and Overall Teacher Judgement (Section 3.3) were used to assess children's reading. As already outlined in Chapter 3, the reading scores did not follow a linear progression and they were adjusted to ensure meaningful statistical analysis.

Table 5.5 shows the mean scores for reading at the three time points. The beginning score for the control group (9.65 (3.86)) increased to 12.70 (4.53) and the intervention group increased from 8.27 (3.43) to 11.31 (3.45). When the frequency was factored in the group using RMT more than four times per week went from 8.80 (3.60) to 10.46 (2.17) and the group using RMT four or less times per week started at 9.22 (3.56) and moved to 13.96 (4.59).

Table 5.5. Mean Reading Scores

Group	Reading Scores at Time 0 (Day 1)			Reading Scores at Time 1 (Mid-point Day 94)			Reading Scores at Time 2 (Completion Day 216)		
	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)
Control	9.65 (3.68)	10.46 (3.48)	8.77 (3.77)	10.80 (3.37)	11.58 (3.67)	9.95 (3.68)	12.70 (4.53)	13.71 (4.72)	11.59 (4.12)
Intervention	8.27 (3.43)	8.23 (3.67)	7.89 (3.25)	9.87 (4.06)	10.04 (4.54)	9.69 (3.60)	11.71 (4.02)	12.12 (4.55)	11.31 (3.45)
<4/week	8.80 (3.60)	9.40 (3.62)	8.22 (3.54)	9.92 (3.67)	10.51 (3.67)	9.33 (3.62)	10.46 (2.17)	10.77 (1.85)	10.21 (2.39)
>=4/week	9.22 (3.56)	9.07 (4.04)	9.42 (3.20)	11.33 (4.41)	11.40 (5.26)	11.25 (3.28)	13.96 (5.14)	14.54 (5.50)	13.15 (4.59)

Note. M = Mean SD = Standard Deviation

Table 5.6 shows that during the research, reading scores increased on average by 3.05 for the control group and 3.42 for the intervention group over the research period. A statistically significant difference between the groups was not detected ($p = 0.3763$)

Table 5.6. Coefficient Estimates for Reading Using Model 1: Group

Reading	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the control group at Day 0	9.59	0.53	18.05	<0.0001
Expected difference in response of the Intervention and control group at Day 0	-1.28	0.72	-1.75	0.0824
Expected effect of adding days to the control group	3.05	0.30	9.96	<0.0001
Expected difference in the effect of adding days for the Intervention and control groups	0.37	0.42	0.88	0.3763

However, Table 5.7 shows that when the frequency of the movements was factored in, a statistically significant difference in the two groups ($p = 0.0020$) was detected. There was no statistically significant difference detected between the two groups ($p = 0.9588$). The group completing RMT for four or more times per week increased their reading score by 4.04 units whereas the group completing RMT for fewer than four times per week increased their reading scores by 2.52 units.

Table 5.7. Coefficient Estimates for Reading Using Model 2: Frequency

Reading	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the ≥ 4 /week group at Day 0	8.93	0.49	17.89	<0.0001
Expected difference in response of the < 4 /week and ≥ 4 /week groups at Day 0	0.02	0.47	0.05	0.9588
Expected effect of adding days to the ≥ 4 /week group	4.04	0.36	11.14	<0.0001
Expected difference in the effect of adding days for < 4 /week and ≥ 4 /week groups	-1.52	0.48	-3.14	0.0020**

Reading: Discussion. Reading involves a range of physical skills (Ayres, 1995; Sassé, 2009) as well as neurological skills. Children need to be able to sit still and focus their eyes on the page, and if there are retained primitive reflexes both these skills can be challenging (Goddard, 1996). As has been mentioned in the DAP discussion, Thelen (2006; 1981; 1996) believes that movement and brain development are linked. Williams (2015) demonstrated that the movement based UP programme improved reading for children engaged in the programme. This research, using RMT, has shown that when the children were using the movements four or more times a week, their reading scores improved significantly. Teacher comments also reflected this: unexpected levels of change were noticed by four teachers where RMT was being used four or more times a week. As has been reported in Chapter 4, the children in these classes showed higher levels of retained primitive reflexes. While Hughlings-Jackson (Franz & Gillett, 2011) believes that ‘dissolution’, or immaturity in the brain is the basis of some psychopathology, Goddard (1996) believes that when the brain is more ‘mature’ not only does behaviour change, but the level of academic achievement increases. Teacher comments about vocabulary improvements support the theories of Vygotsky (Kozulin, 2004; Schneider & Watkins, 1996; Vygotsky, 1987). He linked social context with development, and with increased vocabulary comes improved communication and social skills. This concept is expanded in Section 5.2. The children in this research were using the RMT movement-based programme at the time their reading scores and vocabulary improved. It would also appear that this generic approach to the use of RMT and the limited range of movements was successful in improving reading scores when RMT was used four or more times per week. This advances knowledge around reading and reflex integration and it would appear that this may be an area where change is noticed earlier (94 days) once reflex integration levels begin to increase.

In relation to the increased reading scores, two important factors can be highlighted: cost-effectiveness and student access to intervention. In New Zealand, a common reading intervention is Reading Recovery (Ministry of Education, 2014). This programme is considered an EBP with results showing increased reading skills after children had participated in the programme (Schwartz, 2005). However it has costs associated with the individualised sessions provided and access to this programme is limited by available funding. Another option parents use is self-funded programmes such as Kip McGrath, where children have sessions after school. In both

cases, children are withdrawn from other activities to participate in the individualised sessions. This has the possibility of creating perceptions of difference for the child and for some children this may negatively influence their self-worth (Brooks & Goldstein, 2008). The way RMT was established in the classroom during this research, as a generic programme, greater numbers of children had access to the intervention within the normal school routine. This has the advantage of providing additional support to children who would not normally access it but who may have minor reading challenges. As reported in Section 1.3, RMT is considered a ‘bottom-up’ intervention, targeting underlying difficulties, rather than skill deficits. Hellend, Tjus, Hovden, Ofte and Heimann’s (2011) research comparing ‘bottom-up’ and ‘top-down’ reading interventions found that both approaches were necessary with five to eight-year-olds as they appeared to target different skills. The ‘bottom-up’ approach was useful for emergent literacy skills, and the ‘top-down’ approach was useful for literacy skills. While individualised RMT movements would be ideal, when this generic approach was used, statistically significant differences in reading scores were detected. RMT could be used in conjunction with skill deficit-based programmes such as Reading Recovery. It may be possible that children need less individualised support, either reducing funding needed for such interventions or giving wider access. It may also be possible to have a mixture of generic and individualised use of RMT. Children with identified needs could have an extended range of movements available to them or an extra movement time could be part of specialised tuition sessions. Training specialist education teachers in RMT may be an additional tool that could be used in reading skill development. Children with reading difficulties often have corresponding muscle tone issues (Ayres, 1995) and increasing their physical movement opportunities could benefit these children.

Finally, reading scores were shown to increase while children were using RMT four or more times per week, and Bronfenbrenner’s (2005; Rosa & Tudge, 2013) PPCT theory where the child’s development is positioned within processes, people, context and time and the strengthening of microsystems supports the importance of these results. If five minutes of engagement in RMT movements can make reading easier for children, their perceptions of reading may change and their connectedness with school may improve. Reading is the basis of much learning; study in all subject areas at school relies on reading as an information gathering tool, and resources are allocated to ensure children are confident readers (Stanovich, 1986). RMT

and Bronfenbrenner view the child as a ‘whole’ and importance is placed on comprehensive development, rather than a single aspect. When children are engaged in a specific reading intervention, it is obvious to them that they are working to address deficits. However when they are using RMT it is not obvious what skills are being targeted, and in the generic use of RMT each child is able to complete the movements for their own reason. They may believe they are increasing physical skills, they may enjoy the quiet moment, they may need to improve their reading and the strength of RMT is that they can engage in the process at their own level.

5.1.5 Writing

This section focuses on the writing skills of the children. Teacher observations, in particular, those of Orla, are presented first and then the results from the writing testing. Reading and writing scores were correlated using R (R Core Team, 2018) and the test showed a 0.756 correlation (A correlation score less than + or - 0.70 indicates the conditions are not well correlated). This adds a level of dependability to the results as it could be expected that reading and writing scores would be similar.

Writing: Findings. Teachers in all the schools commented that there had been pleasing gains in the children’s writing over the year as Betty’s comments reflect:

The writing, I think we did a lot of really good things and as a team of teachers we did a lot of reflective discussions and I think we learnt a lot just in this last term (Betty).

Gwen noticed unexpected changes in some of her children. One child (Orla) made remarkable changes. While her writing scores did not change, she went from very early stage marks on the paper to fully formed words in the letter to her mother in one year. Orla was in the intervention group at the beginning of the year, but as noted in Section 5.1, her participation was spasmodic. She would participate when the researcher was in the room, otherwise, she joined the control group. When the second phase of the research commenced, and all the children in the class were completing the movements she participated more regularly. By the end of the year, she was completing four of the five movements accurately. Her writing results are illustrated in Figures 5.3 to 5.5 with exemplars from the Ministry of Education to indicate expected levels of achievement (Te Kete Ipurangi (TKI), 2009).

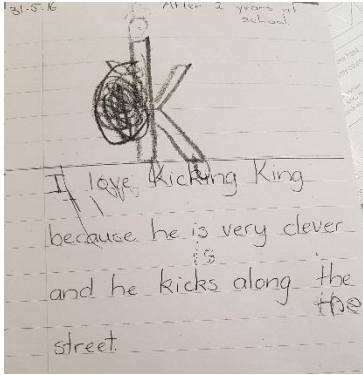
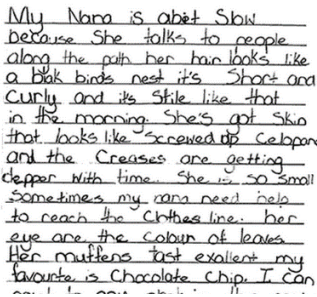
 <p>An adult has written the letter K and a story that was dictated by Orla. Her writing attempts include scribble to colour in the letter 'k' and attempts at the words I, is and the. This sample was taken 6 months prior to the commencement of the research. Orla had been at school for 2 years.</p>	<p>This is a writing exemplar of the writing expected from a child after two years of schooling (Te Kete Ipurangi (TKI), 2009). The NZ Curriculum assessment system uses Levels 1 -8 to ascertain student progress. Further information can be sourced at: http://nzcurriculum.tki.org.nz/National-Standards/Reading-and-writing-standards.</p> 
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Figure 5.5. Orla's writing sample at the beginning of the research.

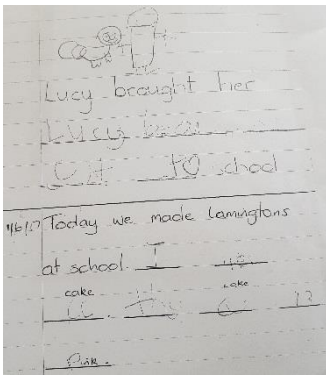
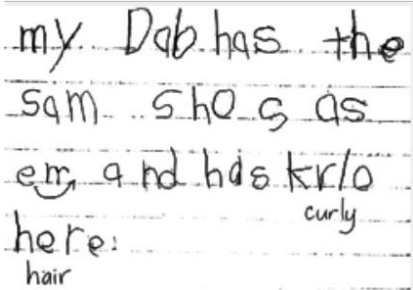
 <p>An adult has written the beginning of the story which Orla has copied. Orla has then written some additional words. The teacher has added some words above words that are not easily distinguished. This sample was taken mid-way through the research when Orla had been at school for 3 years.</p>	<p>This is a writing exemplar of a level 1.1 student, meaning the child has been at school for one year (Te Kete Ipurangi (TKI), 2009).</p> 
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Figure 5.6. Orla's writing sample after 3 years at school – mid-point of the research.

	<p>This is a writing exemplar of a level 1.3 student, meaning the child has been at school for one year (Te Kete Ipurangi (TKI), 2009).</p>
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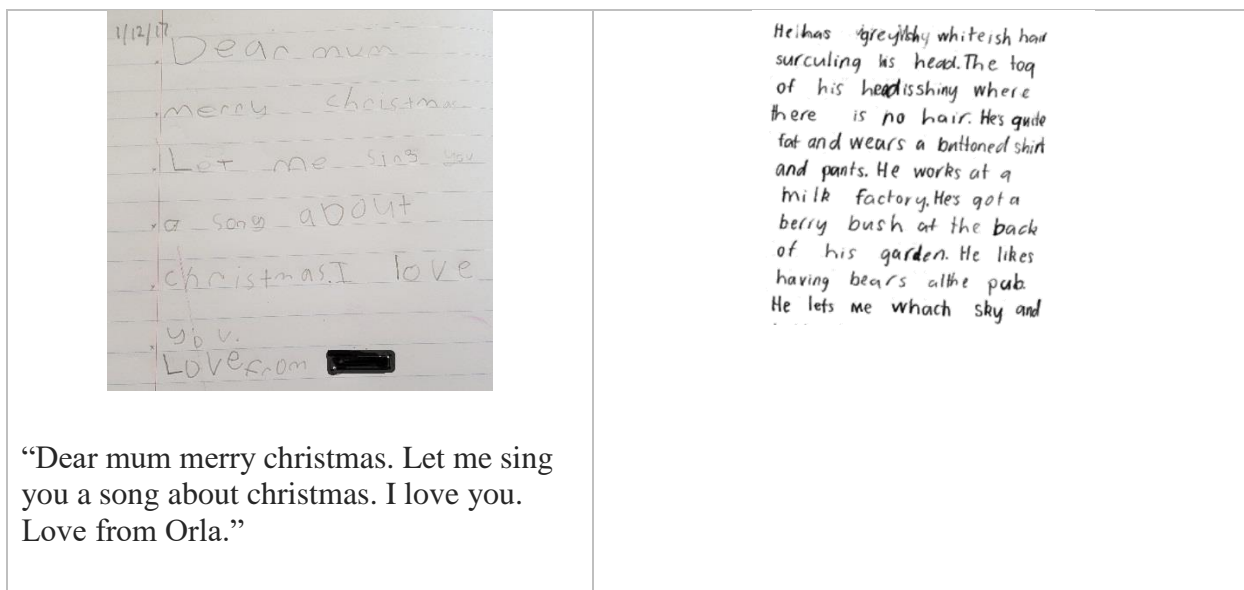


Figure 5.7. Orla’s writing sample at the end of the research.

The three figures show the three testing points during the year. The teacher and specialist teachers working with Orla were surprised by her accelerated results. It is not possible to say that the RMT was responsible for the changes in Orla’s writing, but it is acceptable to say that she was completing RMT when the changes were noticed. Her DAP scores were discussed in Section 5.1, but the general feeling was that her progress rate had increased during the second half of the year. However, Orla’s results did not show statistically, she began the year on Level 1 and remained at that level for the year, despite the significant changes illustrated. This is due to the set standards assessing the progress that would be expected of typically developing children and Orla, while making gains, was not making them at the assessment steps.

Writing: Results. Writing tests were administered by the classroom teachers. All three schools used OTJ and either school-wide records aligned with NZ National Standards or the e-asTTle marking scale. There appeared to be a linear progression with three levels each year.

Table 5.8 shows the Mean writing scores at each test point. Overall the control writing scores improved from 1.96 (1.03) to 3.63 (1.42) and the intervention increased from 1.69 (0.98) to 2.96 (1.27). However, the mean scores of the group that used RMT for four or more times per week went from 1.77 (0.94) to 3.02 (0.91) and the group that used RMT for less than four repetitions per week moved from a score of 1.93 (1.15) to 3.54 (1.70).

Table 5.8. Mean Writing Scores

Group	Writing Scores at Time 0 (Day 1)			Writing Scores at Time 1 (Mid-point Day 94)			Writing Scores at Time 2 (Completion Day 216)		
	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)
Control	1.96 (1.03)	2.22 (1.10)	1.91 (0.97)	3.24 (1.29)	3.29 (1.23)	3.18 (1.37)	3.63 (1.42)	3.88 (1.48)	3.36 (1.33)
Intervention	1.69 (0.98)	1.73 (0.96)	2.19 (1.02)	2.73 (1.22)	2.54 (1.27)	2.92 (1.16)	2.96 (1.27)	2.85 (1.29)	3.08 (1.26)
<4/week	1.77 (0.94)	1.83 (0.98)	1.72 (0.91)	2.97 (1.21)	2.97 (1.20)	2.97 (1.23)	3.02 (0.91)	3.05 (0.84)	3.00 (0.98)
>=4/week	1.93 (1.15)	1.93 (1.16)	1.92 (1.24)	2.96 (1.45)	2.73 (1.53)	3.25 (1.36)	3.54 (1.70)	3.57 (0.89)	3.50 (1.61)

Note. M = Mean SD = Standard Deviation

However, Table 5.9 shows that there was a statistical difference detected between the control and intervention group with the control group improving their writing scores ($Est = 1.62$) at a greater rate than the intervention group ($Est = 1.23$) and there was a statistically significant difference

Table 5.9. Coefficient Estimates for Writing Using Model 1: Group

Writing	Estimate	Std - error	t-value	p-value
Expected response for the control group at Day 0	2.16	0.15	14.37	<0.0001
Expected difference in response of the Intervention and control group at Day 0	-0.29	0.20	-1.40	0.1637
Expected effect of adding days to the control group	1.62	0.144	11.23	<0.0001
Expected difference in the effect of adding days for the Intervention and control groups	-0.39	0.19	-2.00	0.0459

detected ($p = 0.0459$) between the two groups. This means that there was greater improvement in the control group's writing rather than the intervention group.

Table 5.10 shows that a statistically significant difference in the writing scores was not detected ($p = 0.8345$) when the frequency of RMT and writing scores were accounted for. These results indicate that in this research RMT does not appear to influence writing scores when used in a generic way for 94 days. While there is not a clear indication why the control group

Table 5.10. *Coefficient Estimates for Writing Using Model 2: Frequency*

Writing	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the ≥ 4 /week group at Day 0	2.12	0.17	12.10	<0.0001
Expected difference in response of the <4 /week and ≥ 4 /week groups at Day 0	0.10	0.19	0.50	0.6124
Expected effect of adding a day to the ≥ 4 /week group	1.19	0.15	7.57	<0.0001
Expected difference in the effect of adding days for <4 /week and ≥ 4 /week groups	0.04	0.21	0.20	0.8345

achieved greater writing scores than the intervention group, it is noted in Section 4.2 that the intervention group's reflex profiles were greater at the beginning of the research.

Writing: Discussion. As with reading, there are physical skills associated with writing (Ayres, 1995; Goddard, 1996). At seven years of age children need to be able to hold their writing tool and write within the lines provided. When primitive reflexes are present, this process can be compromised. The child may hold the pencil very tightly or incorrectly and they may press very hard on the page; both are indicators that primitive reflexes are still present and are hindering skill maturation (Goddard, 1996). A retained Palmar grasp reflex is often associated with writing difficulties (Blomberg & Dempsey, 2011) and the STNR rock RMT movement was included to encourage the integration of this particular reflex. If the physical writing process is challenging for a child, they may also experience a lack of engagement in the activity. Requiring a child with immature writing skills, based on primitive reflex retention, to practise more will not achieve the desired outcome as quickly as if the reflexes were integrated (Blomberg & Dempsey, 2011). Vision skills are also associated with writing. Children need to be able to use binocular

vision (cooperation of both eyes to achieve depth perception) to write successfully. The visual aspect of the RMT movements was not included in the generic use of RMT and this may have changed the writing results. Including this aspect was viewed as challenging within the classroom environment and this group of inexperienced RMT movement users. Adding progressions was not part of the research design as it would impact on the replicability of the research. However, adding visual skills is a progression that could be considered when the group is more experienced. This is another area that could be considered in future research.

As the results show, the RMT movements used for this group did not change the writing scores significantly although the mean scores for the group completing RMT four or more times each week were higher than the group completing RMT fewer than four times per week. Teachers reported positive changes in the children's writing, but as Orla's results indicate it is possible to make changes but these not be reflected in the statistical score. The exclusion of additional movements associated with the palmar grasp reflex may have impacted the result. However, this then prompts the question, if different RMT movements had been chosen would there have been an impact on writing? These scores may have also been affected by the shorter time using RMT (94 days). It could be possible that writing takes longer to progress once the primitive reflexes are further integrated. This research progresses the understanding that limited time and low frequency completing generic RMT movements does not appear to improve writing skills in children.

5.1.6 Mathematics

This section focuses on the children's mathematics scores and teacher comments. As reported in Chapter 3, the mathematics testing chosen relied on OTJ and a range of unstandardized tests. There is minimal certainty in the results due to the complex structure of testing levels and stages within the mathematics curriculum in New Zealand (Appendix Tm). As part of the Numeracy Project in New Zealand (Te Kete Ipurangi, n.d.), children are assessed on the level they are working at as well as the strategies they are using. They are encouraged to use a range of different strategies choosing the most appropriate one for the problem to be solved.

Mathematics: Findings. The richness of mathematics data was noticeably different in the quantity and quality of responses. Teachers and parents made fewer comments about mathematics than reading. Parents may be more inclined to read with their children rather than solve mathematics problems, therefore they may have felt less able to comment on this area. All teachers were asked about mathematics, but a fleeting “good” type of comment was made without specific details being added. It may be possible that with the structure of the Numeracy Project it is not as clear how children are progressing. With reading, the colours of the books clearly indicate when children are making changes and the reading levels have been in use for many years whereas the Numeracy Project began in 2000 and roll out to schools taking place after 2005. Teachers may have a reading visual in their heads, whereas with maths they may need to look at grade books to get a stronger sense of the progress their children are making. Agatha believed her children (aged five years) had made good gains and these are reflected in her comments made with her grade book in her hand, although she too was more interested in talking about reading changes.

You could say maths is more natural for some children, but certainly, there were bigger increases (this year), if I look at past results there wasn't the same change. We had children by the end of the year that were Stage four, who would normally be at the end of Stage 2 or Stage 3, so there certainly was a lot more starting to cross over and use bigger numbers and deeper strategies (Agatha).

Mildred also noted that some of their children were requiring extension activities and Iris described her ‘skyrocketing’ results. These teachers were using RMT four or five times a week.

We have children here at Stage 6 and 7 maths and they require more extension and, so they are just continuing to track along at the same speed (Mildred)

Maths follows straight away after the exercises. And their maths results, I take the younger ones, and their results have just skyrocketed, so it's great (Iris)

However, the rest of the teachers did not offer specific mathematics comments.

Two groups had their children count the repetitions in their heads as they completed the movements. As already reported in Section 4.4, this provided an opportunity to develop the mathematics counting competency from the NZ Curriculum (Ministry of Education, 2007). Teachers could vary how the children count, where they begin and which direction they count. This increases the flexibility and usefulness of the generic use of RMT in the classroom.

Mathematics: Results. This section reports on the mathematics mean scores and statistical analysis. Table 5.11 shows that mean mathematics scores improved across all groups with the control group (5.43 (2.96) to 8.57 (2.70) showing greater gains than the intervention group (5.04 (2.27) to 7.65 (2.34)). It appears that the frequency of RMT did not impact the mathematics mean scores.

Table 5.11. Mean Scores Mathematics

Group	Maths Scores at Time 0 (Day 1)			Maths Scores at Time 1 (Mid-point Day 94)			Maths cores at Time 2 (Completion Day 216)		
	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)	Overall M (SD)	Males M (SD)	Females M (SD)
Control	5.43 (2.96)	6.04 (2.90)	4.77 (2.33)	7.09 (2.32)	7.50 (2.57)	6.64 (1.97)	8.57 (2.70)	9.46 (2.86)	7.59 (2.17)
Intervention	5.04 (2.27)	5.65 (2.45)	4.42 (1.92)	6.37 (1.91)	7.00 (1.96)	5.73 (1.66)	7.65 (2.34)	8.50 (2.06)	6.16 (2.33)
<4/week	5.28 (2.68)	5.55 (3.11)	5.07 (2.32)	6.79 (2.27)	7.23 (2.51)	6.36 (1.94)	8.14 (2.65)	8.97 (2.77)	7.33 (2.28)
>=4/week	5.17 (2.25)	6.07 (2.36)	3.90 (1.55)	6.48 (1.74)	7.27 (1.62)	5.50 (1.38)	7.93 (2.24)	8.93 (1.79)	6.67 (2.27)

Note. M = Mean SD = Standard Deviation

Table 5.12. Coefficient Estimates for Mathematics Using Model 1: Group

Mathematics	Estimate	Std - error	t-value	p-value
Expected response for the control group at Day 0	5.55	0.34	16.14	<0.0001
Expected difference in response of the Intervention and control group at Day 0	-0.43	0.47	-0.92	0.3583
Expected effect of adding days to the control group	3.10	0.24	12.84	<0.0001
Expected difference in the effect of adding days for the Intervention and control groups	-0.50	0.33	-1.52	0.1291

As Table 5.12 and Table 5.13 show, a statistically significant difference between the control and intervention group ($p = 0.1291$) was not detected, nor was there a difference detected between the frequency of RMT movements ($p = 0.7471$). It would appear that the movements chosen for these children did not significantly change the mathematics scores.

Table 5.13. *Coefficient Estimates for Mathematics Using Model 2: Frequency*

Mathematics	<i>Estimate</i>	<i>Std - error</i>	<i>t-value</i>	<i>p-value</i>
Expected response for the ≥ 4 /week group at Day 0	5.45	0.36	15.08	<0.0001
Expected difference in response of the <4 /week and ≥ 4 /week groups at Day 0	-0.16	0.37	-0.44	0.6537
Expected effect of adding a day to the ≥ 4 /week group	2.85	0.30	9.48	<0.0001
Expected difference in the effect of adding days for <4 /week and ≥ 4 /week groups	-0.12	0.37	-0.32	0.7471

Mathematics: Discussion. Mathematics and neuroimaging were combined in research conducted by De Smedt (2014) where information was gained relating to low-level mathematical processes in adults. This research attempts to understand the biological processes involved in mathematical learning that are difficult to assess through behavioural data alone. It appears that the ability to compare symbolic numbers determines success in acquiring mathematical skills. De Smedt also discovered that children may achieve a similar result on a simple calculation task, but the processing strategies used in more complex tasks differ, and compensatory strategies are highly evident in the brains of children with mathematical challenges. Within this research, the mean scores reflect progress made within the groups, but there was no statistically significant difference in the groups, either intervention/control or frequency. However, it is possible that with the reduction of retained primitive reflexes as reported in Section 4.4, there may be changes in the neurological processes and these are not yet reflected in the behavioural testing. As is similar to the writing scores, it is possible that limiting the exercises to five, from a possible 17 is

the reason for statistically insignificant differences in the groups. However, that is a question for future research. It would appear that the generic approach for the use of the movements was not effective in changing mathematics scores after 94 days. Jordan-Black (2005) found mathematic skill improvement in her intervention group after two years. Also, the standards-based testing using OTJ may have reduced the obvious effect of the movements. The attempt to remove the ‘teacher’ effect by dividing the classes into two groups and then beginning the movements with all children after 94 days may have changed the results. In research where two classes are used from the same school (one class as control and the other class as the intervention group), moderation of OTJ results would be possible making the scores more reliable. However, the ‘teacher effect’ would still be present as a possible cause of change.

Research completed by Ziegler and Stoeger (2010) shows that fine motor skills can influence assessment of mathematics achievement. Tests relying on fine motor skills did not assess children’s ability accurately both for gifted and underachieving students, with only 25% of children tested obtaining similar results on tests with a high reliance on fine motor skills and tests with a low reliance on fine motor skills. Brown’s (2010) research demonstrated an increase in fine motor skills when children were using a reflex integration programme for one year. Blomberg and Dempsey (2011) and Goddard (1996) identify fine motor skill deficits as an indicator of retained primitive reflexes. Although the results in this research do not show significant differences between the control and intervention groups in mathematics after 94 days, it is possible that increasing the integration of primitive reflexes, fine motor skills may improve and there may be a flow-on effect to mathematics achievement. It appears that both writing and mathematics take longer for change to be established. They both use hand-eye co-ordination as part of the testing process. Children develop their gross motor skills before their fine motor skills (Ayres, 1995) and it is possible that more than 94 days is needed for change to be established.

Teachers and parents made fewer comments about mathematics progress over the year. This may be attributed to a feeling from parents that they do not have as much information about mathematics progress and for teachers, the complexity of the Numeracy Project used in New Zealand made it difficult to comment without the grade book at hand.

5.1.7 Parent Comments: Extra-curricular Activities

Parent comments on extra-curricular activity developments are noted in this section. Sport, in particular, swimming, were highlighted. Parents often watched their children during lessons or games and improvements were noticed. Changes in these areas may coincide with behavioural and achievement changes and they illustrate the broad range of skills impacted by retained primitive reflexes. Eight parents commented on extra-curricular skill development they had noticed in their children and five of the parents had children in the intervention group. Charles and Mary (intervention group) commented on the noticeable change in their daughter's swimming. Charles had noticed an increased maturity in his daughter's approach to many activities which appeared to be associated with an increased understanding of purpose.

Charles: Over the year her school work seems to be on the improve. Steady progress and a definite change in her mood.

Mary: Last year for the whole year she was in the same (swimming) level. But this year suddenly she just...

Charles: This year she has been more interested in it, before that she just didn't seem to be. (pause). I don't think she understood why she had to do things. It was just, turn up there for swimming classes and just sort of... (pause). She never really seemed to progress. But now with a lot of things she is starting to understand why these things are happening (Charles and Mary).

Celia (intervention group) noticed changes in her daughter's swimming. She described the swimming at the beginning of the year as being very uncoordinated and immature. By the end of the year, there was a marked improvement. Celia also described her heartache when her daughter wanted to play basketball. She said she could imagine her being the child that never received the ball due to her lack of coordination and poor ball skills. To Celia's delight and surprise, her daughter really enjoyed basketball, she developed excellent skills and was a high functioning member of the team. Student 31 highlighted in the DAP section (Figure 5.3) was Celia's daughter. As has already been reported, her drawings showed marked changes in maturity and she was in the intervention group. Another child, Student 26, had the highest scores in his class for reading and mathematics. In the middle of the year, he made comments that he really liked the movements because they helped his soccer. When asked what it was about the soccer that had changed for him, he replied that it was "way easier to get around the legs now". Statistically, this child's gains were minimal as he was functioning at an already high level, but his perception was that his sport was improving because of RMT. This child would not be offered an

intervention to improve his soccer, but by being part of a group where generic RMT was being used he was able to gain perceived benefits. Zeigler and Stoeger's (2010) research demonstrated that gifted and talented children's assessment was affected when tests relied on fine-motor skills. Children with poor fine-motor skills did not score as well on intelligence tests that relied on fine motor skills, but they had improved scores when tests were used that did not rely on fine-motor skills. As reported in Section 2, Brown's (2010) research demonstrated that a reflex integration programme improved the fine motor skills of the children in her intervention group. It could be advantageous for gifted and talented children to have access to an intervention, such as the generic use of RMT, which allowed them to demonstrate their skills to a higher level. Memmert's (2006) research found that gifted children benefited from an enriched sports programme in relation to the development of their creativity. Again, this highlights the importance of physical skill development for gifted and talented children. For Student 26 the development of his soccer skills may encourage increased creativity of thought.

These comments highlight a range of areas of development, particularly extra-curricular sport, which is important when the whole child is considered as in Bronfenbrenner's (Rosa & Tudge, 2013) bio-ecological theory. Through confidence gained at swimming and associated strengthening of the swimming microsystem, additional microsystems may then be strengthened such as the basketball microsystem which in turn may strengthen the child's confidence at school. If completing RMT improves swimming, basketball and reading this has a greater effect on the child than if they were only completing an intervention that focused on reading. By building relationships in the basketball team it is possible that Celia's child was increasing her social skills which, as Vygotsky (Kozulin, 2004; Vygotsky, 1978, 1987) theorised, influences a child's development. Progressing the understanding of the range and breadth of development when using a reflex integration programme is important when child development embodies the 'whole child' rather than taking segments. A higher value may be placed on increased reading scores by policymakers, but from the child's perspective being a high functioning member of a basketball or soccer team may provide purpose and meaning to their lives. It is possible that RMT may have helped develop the basketball or soccer skills and this is an important development for these children.

5.2 Student Behaviour Findings/Results and Discussion

Social and emotional maturation is another area of child development where changes were noticed by parents and teachers. Defective or delayed development in this area reduces the possibility for change at a typical rate (Melillo, 2011). Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD), as highlighted in the literature review (Chapter 2), are commonly-used diagnoses when children are struggling to manage their behaviour. The participants in this research with ADD or ADHD were not identified, however, the researcher was aware that there were children in all the classes that fitted this diagnosis.

Comments relating to behaviour from both parents and teachers are reported first followed by the results from the Strengths and Difficulties Questionnaire (SDQ). Finally, the discussion links Vygotsky's development theory with the findings and results.

Student behaviour: Findings. Teachers and parents were asked about the behaviours of the children they were in contact with. Teachers made comments about their overall feeling of the group of children, while parents gave more detail about their child. For many parents changes in behaviour were noticed. Comments from this first group of parents relate to children in the intervention group. Charles noticed his daughter's increased maturity:

We have noticed perhaps a change in her behaviour. More grown up I suppose. There are not the same tantrums as such, but her mood has mellowed quite a bit (Charles).

Charles also noticed that his daughter was appearing to understand the logic behind various activities she was engaged in, thus improving her skill level as well as her confidence. Carol also noticed maturation in her daughter's ability to separate from her at the school gate:

She has actually been really good. In the 2 years before this year, she was quite anxious and quite teary. She wouldn't want me to leave and that sort of stuff. By the second term, she was quite happy to let me leave. In the 3rd term, she would run off at the gate while I would come in here (office). And her confidence has grown a lot. This had been the best year so far (Carol).

Being able to transition successfully at the school gate makes the start of the child's day easier and Carol could see the flow-on effect in her child's confidence. Anne had a similar experience with her son.

It has been good from the fact that he has actually enjoyed this year. Whereas last year we had lots of teary mornings, he did not want to go to school. I had to quite often go and sit with him to encourage him to stay in class. But this year he has really enjoyed the programme (Anne – Child D).

Celia also made comments about socialisation and her daughter. She observed 'huge' changes in her daughter's social confidence as well as her ability to express herself. The 'melting' that the family experienced at the beginning of the year when things did not work for her daughter had reduced noticeably by the end of the year. However, another parent noticed that with the increased confidence came increased resistance to following adult instructions. Sophie viewed her daughter's confidence to express her preferences as a positive development and this was how she described it:

I guess she's finding herself in asserting what she wants to happen with things. Kind of putting her foot down and it is harder get her to do what we are wanting her to do a lot of the time. I guess finding confidence in wanting to show that she has some say over what is happening to her now (Sophie).

Jessie noticed issues with self-regulation and her son, but there were signs of maturation emerging:

The worst area is where he can't self-regulate the computer. I think this year we have probably got a bit tougher than we used to be with everything. And so, we have tried to be tougher with boundaries cos we know that they just push and push and push. So yeah, we can see this new person emerging that is a more compromising and listening person (Jessie).

Felicity noticed that her daughter's skills included greater concentration in school as well as increased social skills:

She is definitely better at concentrating for long, much longer periods of time. She can say at times, "I'm trying to deal with my feelings", so definitely this year this is a big development for recognising more, that she is doing it, but how can I actually tackle it (Felicity).

Jane viewed increased engagement with her teachers as a link to her daughter's improved reading:

Well, it's gone really well in the last two terms. It felt like the first two terms were a real struggle and she was just really shy, and she wasn't talking to the teachers or anything like that and she's sort of settled in now I think, yeah, she's gone back up to level 13 reading, so she's, that's a huge improvement over the year (Jane).

Jane's daughter was in the intervention group at Pōhutukawa, but as described in Section 3.4, they began the movements later than the other schools, possibly contributing to the increase in skills in the last two terms of the year.

However, not all children had an easy year. Tina's daughter, was in the control group, struggled with sports days:

It is very hard to get her to school on days when there is athletics or anything like that. She has a fear of loud noises. So, when they use a gun, she just loses it. She can't handle it, balloons, she can't handle it. The only thing I can click on was, she got scared of balloons when her baby brother when he was a baby, he popped a balloon in the Nursery when we were at Pre-school one time. She's been scared since. Anything loud, fireworks. You can't put a balloon near her, she will just scream (Tina).

Reactions to loud noises have been noted by Blomberg and Dempsey (2011) as a behaviour that can be observed in children with retained reflexes. Tina had not noticed any resolution of her daughter's issues with loud noises. Her daughter was in the group that only completed the RMT movements for five weeks and her reflex profile score went from 7 at the beginning of the year to 6 by the completion of the research. This indicates minimal furthering of her primitive reflex integration and it would not be expected that behaviours such as reaction to loud noises would reduce in this case. Nora's son was in the control group and she also commented that he had not had a good year.

Educationally he has gone backwards I think. I don't think socially it has been a good year for him either (Nora).

Maturity and heightened levels of anxiety were mentioned by Nora as possible issues. On investigation, his reflex profile started at a score of seven and by the end of the year, it had moved to a six. However, his DAP had moved from a mental age of 5.75 at the beginning of the year to 8.00 at the end of the year. So, while he had made some progress on the DAP and reflex profile, Nora's impression was that he was not making gains that matched her expectations. She was also comparing his progress with that of another of her children.

Parents were asked about their child's social skills during the year. Seventeen of the parents noticed their child building stronger friendships, maintaining friendships and extending their friend base. They talked about confidence gained through having stronger friendships. Nine parents felt their child was still learning to make lasting connections with other children. The

children often knew the names of many children, but they did not play regularly with the same children.

Teacher comments reflected friendship issues the children were having at this stage. Four teachers talked about the time spent helping children negotiate relationships and as reported in Section 3.4, Kauri was using Sunshine Circles (Theraplay Institute, 2017) with their group of children to develop social skills for the children. Edith commented that girls appeared to have greater needs when friendship skills were being developed. She observed the following:

We have many friendship issues with girls. So, it starts here (Year 3) and then it gets worse next year. It's just that friendship group, they're just getting their feet and they want to be the boss and that kind of stuff. So, that's been an issue, for the last six months. And then next year it's a real problem (Edith).

Agatha also felt she was mediating children's social challenges throughout the year and she had not noticed changes within the group while using RMT when she compared this with the changes she had noticed in reading.

Mildred and Iris noticed changes in their group, and they believed that these changes were in part due to the inquiry-based learning environment, but also RMT had contributed. Iris was asked about her perceptions of the social skills within the group:

Amazing, so we have got a mix of Year 2, 3 and 4 children in here and they have been used to mixing with their same age group. The Year 4's will now work comfortably with the Year 2's, help them, and they know the younger children, have got things to offer them as well. So there's mutual benefit going on, both ways and it is lovely to watch. I mean, children that would have no contact with a child, two years younger than them are now playing with them, talking with them and asking their opinions and stuff, it's lovely (Iris).

Betty made comments that related to the timing of the interview when asked about the children's social skills. She concluded that the changes of routine at the end of the year had impacted their skills and the difference was noticeable:

You know if you had asked me this a month ago it would have been a different answer. But you see we've gone off our routines. And I mean once we go off our routines, it is really hard for the children. We have been swimming now for three weeks, and that wears them out and that's a new routine and we are in new groups and things and it takes a toll (Betty).

As observed in the DAP testing (Section 5.1) the children at all three schools were tired and some were out of routine at the end of the year. Teachers expect this and so do their end-of-year testing

earlier in the term. Gwen from the 25-child class did not comment about social skill challenges for her children. She felt her class was managing well. Although this research was not focused on the difference in size of ILEs, it was noted that as the class size increased, the number of relationships needing maintenance increased and the perceived social issues increased.

Student behaviour: Results. The Strengths and Difficulties Questionnaire is divided into five sections when being scored: emotional problem scale, conduct problem scale, hyperactivity scale, peer problem scale and prosocial scale. Table 5.14 shows the SDQ classification of scores (Appendix N) and the scores for the participants at Time 0. The overall scores of the participants

Table 5.14. *SDQ Classification Score Levels and Participant Levels*

Teacher completed SDQ	Classification Scores based on UK Community sample				Participant Scores at Time 0	
	Close to Average	Slightly raised (slightly lowered)	High (low)	Very high (very low)	Control	Intervention
Overall SDQ score	0 – 11	12 – 15	16 – 18*	19 – 40 *	19.13	18.98
Emotional problem score	0 – 3 *	4	5 - 6	6 - 10	1.73	1.55
Conduct problem score	0 – 2	3 *	4	5 – 10	2.16	2.22
Hyperactivity score	0 – 5 *	6 – 7	8	9 – 10	4.25	3.91
Peer problems score	0 - 2	3 – 4	5 *	6 - 10	4.24	4.24
Prosocial score	6 – 10 *	5	4	0 - 3	7.29	7.89

Note. *Grey highlight shows where the research participant scores are within the classification scores.

were at the high to very high level (19.13 for the control and 18.98 for the intervention group). A score of 0 – 11 is considered average (Appendix N). Other scores noted were raised levels of peer problem scores (4.24 with 0 – 2 considered an average score). As reported in Section 3.4,

Kauri had implemented the Sunshine Circles programme to address issues surrounding peer relationships. Scores for emotional problems, conduct problems, hyperactivity and prosocial skills fell within the average range (Table 5.14) at Time 0 of the research.

For statistical analysis the linear mixed effects model was used even though only two measures were taken: beginning and end of the research. Accounting for repeated testing of individuals still needed to be considered. Both parent and teacher scores were used in the calculations. Table 5.15 shows that overall, no statistically significant difference was detected between the control and intervention groups ($p = 0.7470$). When each area was scored separately, no statistically significant difference was detected between the control and intervention group.

Table 5.15. *Coefficient Estimates for SDQ Using Model 1: Group*

	<i>Estimate</i>	<i>Std error</i>	<i>t value</i>	<i>p value</i>
Overall SDQ				
Intercept - control	19.90	0.55	35.59	<0.0001
Intervention	-0.24	0.76	-0.32	0.7470
Emotional Problem Scale				
Intercept - control	2.01	0.30	6.57	<0.0001
Intervention	-0.52	0.41	-1.23	0.2181
Conduct Problem Scale				
Intercept - control	2.30	0.14	15.37	<0.0001
Intervention	0.07	0.20	0.34	0.7320
Hyperactivity Scale				
Intercept - control	4.43	0.23	19.21	<0.0001
Intervention	-0.30	0.31	-0.97	0.3306
Peer Problem Scale				
Intercept - control	4.09	0.10	38.05	<0.0001
Intervention	-0.04	0.14	-0.33	0.7372
Prosocial Scale				
Intercept - control	7.05	0.34	20.46	<0.0001
Intervention	0.56	0.47	1.18	0.2388

However, when the frequency was included (Table 5.16) there was a statistically significant difference between the groups overall ($p = 0.0245$) with the four or more times per week group having a higher SDQ score than the less than four times per week group (a lower score is desirable). When the areas of the SDQ were separated there was a statistically significant difference detected between the less than four times per week and the four or more times per week groups for emotional problem scale ($p = 0.0230$) and conduct problems ($p = 0.0012$). This would indicate that when using RMT four or more times each week improvements were observed in the SDQ scores overall but in particular the emotional problem scale and the conduct problem scale.

Table 5.16. Coefficient Estimates for SDQ Using Model 2: Frequency

	<i>Estimate</i>	<i>Std error</i>	<i>t value</i>	<i>p value</i>
Overall SDQ Frequency				
Intercept - ≥ 4	19.67	0.47	41.09	<0.0001
Frequency $< 4/\text{week}$	1.41	0.62	2.26	0.0245*
Emotional Problem Scale				
Intercept - ≥ 4	1.25	0.29	6.25	<0.0001
Frequency $< 4/\text{week}$	0.95	0.41	2.31	0.0230*
Conduct Problem Scale				
Intercept - ≥ 4	2.01	0.13	14.46	<0.0001
Frequency $< 4/\text{week}$	0.64	0.19	3.33	0.0012**
Hyperactivity Scale				
Intercept - ≥ 4	4.07	0.22	18.07	<0.0001
Frequency $< 4/\text{week}$	0.38	0.31	1.22	0.2227
Peer Problem Scale				
Intercept - ≥ 4	4.07	0.15	38.62	<0.0001
Frequency $< 4/\text{week}$	-0.00	0.14	-0.01	0.9843
Prosocial Scale				
Intercept - ≥ 4	7.63	0.33	22.61	<0.0001
Frequency $< 4/\text{week}$	-0.55	0.47	-1.17	0.2428

Student behaviour: Discussion. Culture, language and social interactions are essential elements in the development of a child according to Vygotsky (Kozulin, 2004; Louis, 2009; Vygotsky, 1978). Vygotsky's insights encourage children to independently construct learning through active engagement. Education is viewed as a process in development, rather than development being viewed as a consequence of education. RMT has been shown to allow the child to control aspects of the learning through the movements. Children can determine the speed of the movement and in some classes, they were able to choose the movements they completed using feedback from their body. However, as discussed in Section 4.4, behavioural aspects related to the NZ Curriculum (Ministry of Education, 2007) key competencies such as self-management, relating to others, participating and contributing were observed during the RMT trial process. Using a Vygotskian approach these children were actively participating in gaining knowledge. As Kozulin (2004) notes, it can be challenging for teachers to allow children to take greater control of their learning. This was reflected in teacher comments in Section 4.4 where some wanted to determine which movements were completed.

Vygotsky believed that literacy was acquired through a range of interactions and reading was not the only significant measure (Vygotsky, 1978). He saw social interactions as essential in the development of a child as they provided feedback and simulation of ideas which are means of developing psychological functioning. Problem-solving is also developed through social interaction and he believed that transferring responsibility for psychological functioning from the adult to the child enhanced development (Schneider & Watkins, 1996). The SDQ scores showed that this group of participants had high to very high levels of social and emotional difficulties. However, the high-frequency use of RMT group showed statistically significant differences (improvement) at the completion of the research. Mutch (2017) and Rucklidge (2012) report on the emotional stress for people following the Canterbury earthquakes and this may provide insights into the high scores in the SDQ of these children. The children using RMT at a higher frequency improved their SDQ scores and when Vygotsky's sociocultural theory is in focus, this change in social and emotional skills has the potential to impact the children's development. The parents talked about the emotional and social changes their children in the intervention group made, and making friendships was commented on. Through increased social skills and reduced emotional difficulties children also have the possibility of strengthening their microsystems

(Bronfenbrenner, 2005; Rosa & Tudge, 2013). If a child has stronger connections with children at school it is possible that being in the environment will have positive associations, which can then enhance learning.

Maturation featured in several parent comments. Retained primitive reflexes have been identified in Section 2. 2 and 2.3 as part of the maturity process. When primitive reflexes integrate, maturity progresses (Goddard-Blythe, 2005) and when the lowered reflex profiles of these participants were combined with parent comments it was shown that while these children were completing RMT maturity changes were noticed and SDQ scores reduced.

Progressing understanding of the relationship between the use of a reflex integration programme and changes to social and emotional competency is important when the ‘whole child’s’ development is considered. Social skills are used by the child to establish wider and more complex microsystems: a factor of Bronfenbrenner’s (2005) bio-ecological theory. The understanding that many of these participants had experienced the Canterbury earthquakes may influence their social and emotional maturity. While some participants had been diagnosed with ADD/ADHD the SDQ scores indicated that the social and emotional issues in this group of participants were evident across the whole group. Additional support through a generic reflex integration programme may benefit children socially and emotionally through low-cost, low impact intervention. RMT can be used in a way where children are not singled out or and made to feel different while effectively lessening social and emotional challenges.

This research does not report on how a reflex integration programme works. However, the movements are repetitive, and teachers reported that they calmed children. It may be possible that they provide a mindful moment of calm for the child when there is no pressure to perform. When the movements have been learned it may be almost a small meditative time. Mindfulness training has been shown to be effective in reducing perceived stress in primary school-aged children (Costello & Lawler, 2014). It is possible that RMT could provide that time of calm in a child’s day.

The changes in the physical structure of New Zealand schools from one teacher classrooms to multiple-teacher ILEs has created environmental challenges for some children. Children may

find it difficult to focus, they may become lost within the bigger group of children and for some the increased noise levels can be problematic. One teacher commented that the children found changes in routine and having new groups for swimming challenging at the end of the year. With ILE's it is possible that class relationships are not as strong as there are so many more relationships to maintain. Many of these challenges have been associated with retained primitive reflexes (Blomberg, 2015; Blomberg & Dempsey, 2011; Goddard, 1996) and it is possible that the changes in classroom structures are accentuating these issues for children. Challenges that were not obvious in smaller groups are now having to be addressed within larger groups. It has been shown that a reflex integration programme may be useful in helping children increase their social skills and lessen their emotional challenges.

5.3 Summary of Chapter 5

Quantitative results in this chapter are combined with qualitative findings from teachers, parents and the researcher. This mixed methods approach has allowed greater exploration of the meaning of some results and has captured more of the 'whole child' in relation to achievement and behaviour. Questions have been raised through both the findings and the results: some of them are answered and others are not, as is common when understanding is based in hermeneutic circles.

The findings, results and discussion in this chapter show that the seven teachers interviewed believed that the children had made good to very good gains over the year, and for many, the gains were greater than expected. Teachers observed noticeable changes in reading skills and these comments were supported by statistically significant differences detected between the children using RMT for four or more times per week and those using RMT fewer than four times per week. The generic use of RMT would appear to be a useful tool for increasing reading skills in children aged six to eight years. Parents noticed changes in children's skill development during extra-curricular activities and these changes appeared to increase the child's confidence. Children made some neurological gains as assessed through the DAP as well as gains in mathematics and writing but no statistically significant difference was detected between the control and intervention groups or the frequency groups. It has been reported that mathematics results may be linked with fine-motor skills. The areas in this research where statistically

significant differences were not detected all involved fine-motor skills, writing, DAP and mathematics. It is known that children develop gross-motor skills before they develop fine motor skills (Ayres, 1995) and these results suggest that reading skills develop before hand-eye fine motor skills. However, children use devices and technology more as communication/entertainment tools, and it is possible that their hand-eye skills are not as developed as they may have been in the past when drawing and writing were more prevalent.

Statistically significant difference was detected between frequency groups in relation to social and emotional difficulties. The children scored highly in the area of social and emotional challenge at the beginning of the research and this may have been a result of their experiences in the Canterbury earthquakes. When RMT was used four or more times per week SDQ scores reduced at a greater rate than for children using RMT less than four times each week. This is important information when Bronfenbrenner's (2005; Rosa & Tudge, 2013) bio-ecological model is in focus where the development of the 'whole child' is viewed as paramount. If using RMT enables a child to make better connections within their microsystems through reduced social and emotional challenges, then these strengthened microsystems encourage positive opportunities for the child to develop further. Vygotsky placed an emphasis on language and social interactions when development was considered (Kozulin, 2004; Schneider & Watkins, 1996; Vygotsky, 1978). The use of an intervention with the ability to improve reading skills, increase vocabulary and develop social and emotional skills is of value within a curriculum that promotes the wellbeing of the whole child. The key competencies from the NZ Curriculum supported by the recorded changes using RMT are the use of language, symbols and texts, self-management skills and relating to others. RMT also provides a calm and possibly 'mindful moment' which supports research finding that mindfulness is effective in reducing stress for children. This research advances the understanding that there are possible developments in reading, social and emotional skills for children when they participate in a reflex integration programme.

As reported in this chapter, these results were achieved using RMT in a generic way with access to a limited range of movements. While the research design required this approach in order to ensure replicability, it has been proposed that increasing the range of movements may have an

increased effect on skill development. The research design ensured that the teacher effect was reduced. However, this limited the time where teachers could be expected to divide their groups. This research progresses information about the length of time required to use reflex integration programmes in this generic way. It would appear that five months is not long enough to record statistically significant differences between a control and an intervention group and that if teachers are going to commit to using RMT, then a full school year could be advantageous for the children. It has been shown that the number of times the movements were used each week also changed the detectable differences in groups. Four to five sessions using the movements each week made detectable differences to reading and the children's social and emotional skills. Strengths of the programme include the brief period each day needed to achieve these results, the availability of the intervention to children with minor challenges and the way children are not made to feel different or singled out in any way.

Chapter 6 Conclusion

6.1 Introduction

The phenomenon of retained primitive reflexes has been the focus of this research. Addressing the retention of reflexes through reflex integration programmes has been established through the review of literature as an effective intervention. The aim of the research was to explore the management of RMT in the classroom and any possible influences on curriculum goals, student achievement or behavioural outcomes. The overriding research question used to was: *What influences does the use of Rhythmic Movement Training (RMT) have in a classroom?* Recent research has identified the retained primitive reflex phenomenon as an issue for some children, particularly those with learning and behavioural challenges. The identification of primitive reflex retention is viewed as a ‘bottom-up’ approach where the possible underlying causes for learning and behavioural challenges are the focus rather than remedying skill deficits as in ‘top-down’ interventions. The mixed methods approach to this research allowed the gathering of a range of data aimed at increasing understanding of reflex integration programme use within a classroom and the areas for possible skill development in children aged six to eight years.

The theoretical framework detailed in Chapter 3 used a rainbow to illustrate the interconnectedness of all aspects of the research. The intervention was placed at the bottom of the rainbow as the phenomenon in focus and all the elements of the research formed supportive coverings, the participants and their perspectives, the test results, the methods of data gathering and the pragmatic paradigm with both positivism and naturalistic approaches. The use of statistical analysis and hermeneutic circles allowed a range of information to be explored. However, what also became evident as the research progressed were complexities associated with the retained primitive reflex phenomenon and the appropriateness of the rainbow symbolism. The integration of primitive reflexes focuses on the whole child, and there are multiple layers (colours of the rainbow) of possible changes in development through reflex integration. The rainbow could also symbolise the NZ Curriculum where multiple layers have components from other layers to form a whole, each layer supporting the layers on either side.

Through this research it was shown that a reflex integration programme could support several Key Competencies in the curriculum.

Rhythmic Movement Training (RMT) was the reflex integration intervention used in this research. Ninety-eight New Zealand children used the programme for between five and ten months. While RMT movements are commonly used as an individualised programme with children in a therapeutic situation, this research has advanced knowledge in relation to the use of RMT in a generic approach within mixed-ability classrooms. The research has found that RMT was easy to use in a group setting, the six to eight-year-olds engaged with the movements willingly and the amount of time, five minutes, required daily was considered manageable by the teachers. Distributed practise theory provided an explanation as to why not only duration, but frequency of completing the movements was important. While using RMT in a generic way with a group of children, this research showed that when completing the movements four or more times each week statistically significant differences to reading, social and emotional outcomes were detected. Engaging in the RMT programme in a generic way for five months was not long enough when the movements were completed for less than four times per week to detect statistically significant differences between the control and intervention groups.

While using RMT in this research, children's reflex profile scores reduced and statistically significant differences were detected between the frequency group using RMT four or more times per week and those using RMT fewer than four times a week. Along with the integration of primitive reflexes, reading scores improved and emotional and social challenges decreased by statistically significant levels within the group using RMT four or more times each week. Teachers reported an increase in the children's focus while they were using RMT during the research and parents reported improved skills in extra-curricular activities such as sport, with gains noticed in self-confidence and social competence. Teachers also reported the calming influence RMT had on their children, who appeared more able to engage in learning tasks after practising the movements. Parents talked about increased maturity for their children and this was evident in skill development both inside and outside the classroom.

The results and findings support Hughlings-Jackson's (Franz & Gillett, 2011) theories that some psychopathology is grounded in the retention of primitive reflexes. This was demonstrated

through the high levels of retained primitive reflexes found through assessment of this group of children, combined with high levels of social and emotional challenge recorded. The reflex integration programme was being used four or more times per week when the social and emotional challenge scores reduced. Thelen (1981) believes that movement and development are linked and that the movements made by infants are essential to brain development. Perry (2008) suggests that therapy targeting the associated brain development stage and the onset of dysfunction is an effective intervention approach. RMT, using movements based on infant movements and targeting primitive reflex retention, aligns with Thelen's and Perry's theories. The maturation process of the reflexes commonly takes place in the early months of a child's life with birth complications or maternal stress being implicated as interrupters of typical progression. Using an intervention that focuses on movements made by infants supports Perry and Thelen's theories. RMT addresses possible maturity issues by focusing on retained primitive reflexes.

The theories of Bronfenbrenner and Vygotsky were used to increase the understanding around the use of RMT. Bronfenbrenner's bio-ecological theory of human development locates the child and their environment at the centre of development. He believes that children are influenced by and can influence their development through the range and quality of interactions they have within their environment. This research about the use of RMT supports this theory; completing the movements may change the rate of a child's development and the child has the ability to self-manage the movements. Bronfenbrenner's developmental theory focuses on the 'whole' child and RMT aligns with this theory. The range of documented challenges associated with retained reflexes spans both educational and psychopathological areas for children. An intervention that focuses on the 'whole' child has the potential to address challenges in both spheres. The New Zealand Curriculum document (Ministry of Education, 2007), while focused principally on learning outcomes, has important goals associated with the well-being of the 'whole' child when shaping life-long learners. RMT addresses retained primitive reflexes which, when integrated, allow the 'whole' child to mature, with the possibility of targeting specific areas of immaturity. This holistic approach associated with RMT is a strength of the programme. Vygotsky believed that social interaction, culture and language play an important role in children's social and emotional development. He saw children constructing their knowledge and understanding

through participation within a group. It was shown that while using RMT children's social and emotional challenge scores reduced. When using RMT it is not necessary to identify the skill being targeted which reduces the need to identify children's skill deficits and helps to maintain their feeling of self-worth. Positioning RMT within Bronfenbrenner's and Vygotsky's theories created increased understanding for the researcher in relation to the power of the individual to influence their development, and also a shift in thinking around the use of RMT within the group. It may be possible that children's development is enhanced further when they use RMT within a group, especially as was illustrated with Orla and her learning challenges. It was easier for her to complete the movements when it was a 'whole class' activity.

The findings and results offer possibilities for either reduced resource needs for children with challenges, or the ability to offer more support to children with identified needs. This puts greater value on primitive reflex identification and integration for policymakers and teachers. As already reported, during this research RMT not only improved the school experience for the child, well-focused children with fewer emotional and social challenges were easier for teachers to engage in learning. The generic use of RMT meant that individual children's skill deficits were not highlighted, as everyone was using the movements. This may help to preserve children's self-worth. The children were engaged in physical activity, and as noted by teachers, it was completed in a quiet, mindful manner. These two components were not assessed and represent a shift in researcher thinking, but other research (Costello & Lawler, 2014; Williams, 2015) presented the benefits of both mindfulness and physical activity.

It appeared that during this research, RMT provided a range of possible benefits for children. The investment of time and resources was minimal and teachers observed improvements around focus, behaviour and achievement in their groups of children that they attributed to the time RMT was being used. However, this research was exploratory and questions have been raised as to how the programme could be extended to meet a greater range of needs. The reflections and limitations described in the next section begin that dialogue.

6.1.1 Hermeneutic Reflections and Research Limitations

It is important to acknowledge limitations in research and reflect on these limitations so as to enhance future research. Limitations within school-based quasi-experimental research are expected due to situations beyond the control of the researcher and the expected differences between classes and teachers. The research questions positioned this research in the classroom, but each classroom had an individualised approach and routine. Group size was another limitation of this research. Fifty participants in each group offer an indication as to the effect size of the intervention, but a larger group would provide more reliable information. Interviews with seven teachers and 26 parents provided limited information about the group, however, the insights gained have raised additional questions for further research (Section 6.1.2). The mixed methods approach allowed a range of perspectives to be explored through qualitative data and a hermeneutic approach.

Using the non-standardised NZNS testing system found in New Zealand schools was problematic; overall teacher judgement and limited standardised tests used possibly reduced the reliability of the results. The decision to use existing systems was made due to the extensive testing children undergo as part of their school experience and it was viewed as important for the wellbeing of the children not to overload them with additional academic testing.

The different styles of classrooms created additional challenges when the teachers were asked to divide the groups in two so that there were control and intervention groups. Additional accommodation of needs and communication were required between teachers where there was more than one teacher in the group and time was spent waiting for groups to join back together again. This added pressure to an already pressured class routine. Using two separate groups within the same school might have solved this problem. The teachers in the 25-child class and 40-child class had fewer challenges with the divided groups, but all noticed it was easier when the whole group was participating in RMT movements.

The decision to divide the groups within the class was made to remove the possibility of a 'teacher effect'. This was to ensure that any effect noticed could be aligned with the movements rather than teaching styles and experience. However, this approach did add challenges for the

teachers. Limiting the intervention to one school year was done so that children were with the same teacher for the year, again an attempt to limit the ‘teacher effect’. Ethically, in New Zealand it is not acceptable to offer an intervention to half a class, so the multiple base-line approach was used to ensure all children had an opportunity to participate. The study design would need to be modified to address the ethical issues.

Limiting the number of movements to four was to ensure teachers did not have to learn too many movements and that RMT was manageable as an activity. However, the results have left questions about what would have happened if more movements had been on offer so that children could address a greater range of primitive reflex retention needs. Were some reflex issues missed because the movements chosen did not meet a child’s specific needs? Would too many movements be challenging for teachers? Would too many choices be challenging for children? How would the extended range be introduced? How could this increased range of movements and flexibility regarding choice be managed from a research perspective? The movements chosen were easy to use and could cover a range of primitive reflexes, but it was understood that these movements would not suit all children. Also, to maintain replicability of the research the movements were not altered according to changes in the children. This feature of the RMT programme relies on teacher training and experience of RMT and was outside the research parameters. RMT can be challenging to use with highly sensitive children (Blomberg & Dempsey, 2011) who may find the movements difficult. Increases in negative behaviours in such cases have been reported. However, with training it is possible to guide children through the process and achieve positive results. Additional research is needed in this area to establish how highly sensitive children could be managed within the group environment, and by whom.

Another limitation of the research was the generic use of the movements. RMT is typically used in a therapeutic setting with an individualised menu of movements. However, this research progresses information and understanding about what happens when a generic approach is taken to RMT. It is possible that generic use combined with a level of individualisation of RMT could be more effective for children with behavioural and learning challenges. Further research is needed in this area.

6.1.2 Further Research

This research has raised questions that could be explored through additional research. While it appears that five months (94 days) completing the movements three or more times a week is not long enough to see a change in children's academic skills and behavioural outcomes, would these be evident after one year of completing RMT movements in a generic way? Is frequency still a significant factor when the duration is extended? What would happen if there was a mix of generic classroom RMT use and specialised use with children identified as having learning or social challenges? Using this with younger children may have a greater impact on learning and skill development, but would this be practical with a group of five-year-olds? In line with a focus on early intervention RMT could be used in an early childhood setting but the practicalities of this need further investigation. Small group activities, commonly found in early childhood settings may be the vehicle for implementation of RMT. Using the 'whole-group' approach as implemented in this research is unlikely to gain traction with large groups of younger children.

The reflex tests used in this research do not appear to have established reliability statistics. It would be useful to have these statistics for further research in this area. The tests chosen were used by experts in the field and it would be advantageous for researchers and practitioners to have a set of tests that provide reliable, consistent results. Also, further testing of reflexes relating to gender may be useful. Males show higher levels of ATNR retention (McPhillips et al., 2000; McPhillips & Jordan-Black, 2007b) but what about other reflexes?

Research focused on 'how' reflexes integrate, patterns of integration and length of time needed to integrate different reflexes was not found. Do different reflexes behave differently in relation to integration? Which, if any, reflexes are influenced by environmental or nutritional factors? If answers to these questions had greater clarity, intervention strategies could be more effectively targeted to the particular challenge.

A perceived strength of the RMT programme by some teachers and parents was that the child could choose the movements they completed, and in the order that suited them. For some teachers, this was difficult and they preferred to choose the movements and the order. Research that evaluated the difference between the two approaches would be interesting when considering

the self-management aspect of the NZ Curriculum (Ministry of Education, 2007) and the child-centred learning objective pervades in NZ classrooms. Is it possible that the child knows what they need when they are encouraged to complete the movements they like and that make them feel good? Or is RMT more effective when the adult decides what is needed based on observable challenges? Alternatively, would a mixture of teacher and child directed movement engagement be most effective? Another possibility may be to collect data from children who have used both approaches. How did they feel about being able to choose or being told which movements to use? Why did they feel that way?

With the development of neuroimaging, it would be interesting to learn what changes are occurring in the brain when completing an RMT programme. The first study would need to establish the difference between the brains of children where there are high levels of retained reflexes evident, and brains where the reflexes are fully integrated. A next step might be to assess the brain of a child with high levels of retained primitive reflexes and assess any changes that may occur over time as they participate in an RMT programme. This would be useful in understanding how or if reflex integration programmes change brain physiology.

Further research using standardised mathematics and writing tests would increase the understanding of these subject areas. It has been acknowledged in this research (Section 3.3) that the testing used, based on the NZ National Standards (Ministry of Education, 2009a), was not standardised and was based on OTJ. Negotiation would need to take place with schools to replace existing mathematics and writing testing with standardised tests so that children were not subjected to increased testing regimes. The use of RMT would need to be undertaken for one school year.

Another area for further research could be combining RMT with existing EBPs. It is possible that skill deficit based reading programmes may have increased effectiveness when RMT is included in the child's day. Another possibility is the combination of RMT with research such as micronutrient research (Rucklidge et al., 2012). There is evidence that some children with an ADD/ADHD diagnosis benefit from the addition of micronutrients. Would adding RMT improve the behavioural outcomes? For the children where micronutrients were not effective, would including RMT be beneficial?

Music teachers may find that RMT is a useful tool. The rhythmic element of the movements and the effect on musical skills were not assessed during this research, but it would be interesting to find out if RMT can influence a child's ability to learn a musical instrument.

Stress has been implicated in the retention of primitive reflexes (Blomberg & Dempsey, 2011). Many of the children in this research were young during the Canterbury earthquakes and this was suggested as a possible cause for the high reflex profile scores. Reflex profiles from children from an area that had not experienced an event such as an earthquake close to the time of their birth were gathered. Superficial data analysis indicated that their scores were different from those of the Canterbury group, but detailed analysis would be useful to determine any statistical differences. It would be interesting to compare those reflex profiles with those of children from other countries where natural disasters have been experienced close to their birth, such as Japan's earthquakes and tsunami, California's bush fires, or Australia's drought.

While the current research attempted to remove the 'teacher effect' by containing the control and intervention groups within each class, it has been acknowledged (Section 4.4) that this was problematic. Further research using teachers from the same school with similar perceived teaching abilities would further increase the understanding of using generic RMT and establish the range of development associated with the use of RMT. Research associated with primitive reflex integration programmes have all used this approach (Brown, 2010; Goddard-Blythe, 2005; Jordan-Black, 2005; McPhillips et al., 2000; McPhillips & Jordan-Black, 2007b) although RMT was not the intervention used in any of these studies.

As reported in Section 2.1, no literature focused on retained primitive reflexes and adolescents was found. It is possible that some immaturity associated with adolescent behaviour could be based on retained primitive reflexes and that using RMT may be useful. However, Gazca (2012) reported comments from practitioners showing that teenagers, particularly boys, did not enjoy the movements and the students were challenging to engage in the programme.

Finally, it would be interesting to compare the high school results of children with high reflex profiles at six or seven with children who had high scores at the same age but had used a reflex integration programme. What are the long-term gains, if any, and what effect does a reflex

integration programme used between the ages of five and eight have on the teenage brain during what are typical changes at that stage? Could children have an easier path through adolescence with higher levels of integrated primitive reflexes? This could change the strength of the microsystems in the adolescent's environment and reduce the amount of possible support required.

6.1.3 Recommendations from this research

This research has shown that Rhythmic Movement Training (RMT) as an intervention was easy to implement and could be used in a generic way within the physical confines of a classroom. Children aged six to eight were easy to engage and willingly used the movements. Children younger than six were not used in the research due to reliability issues. Leaving children with their retained primitive reflexes for the first two years of schooling fails to take advantage of a valuable opportunity to establish sound learning patterns and develop confident learners. While children of this age may not be reliable research participants as identified in Section 3.4, due to being in a new environment, they are well able to complete the RMT movements accurately. Teachers and parents noticed changes in reading, social and emotional skills in the participants and these findings were supported by quantitative results. It was noted that the areas where statistical difference was not detected all involved the fine-motor skills of hand-eye coordination. This may be due in part to the changing way children communicate and entertain themselves, technology having replaced paper and pencils, with the possible decline in hand-eye skills. Does this mean that teachers need to re-assess how they teach and/or test children, choosing testing methods that do not rely on hand-eye skills? The possibility that children can take responsibility for choosing preferred RMT movements adds opportunities to develop self-management skills. However, the most important aspect of RMT is its '*bottom-up*' approach: addressing some of the possible underlying causes for achievement and behavioural challenges. In the same way that ears and eyes are medically screened in NZ four-year-olds, there could be primitive reflex screening with additional support given to those in most need. This approach would require additional training in primitive reflex testing for B4 School (Ministry of Health, 2015a) registered nurses who perform the tests. This could identify the children at greatest risk of having maturity-based issues.

Including primitive reflex information in teacher education would also be advantageous for children. If teachers were able to recognise that some apparent skill deficits could be related to retained reflexes and associated immaturities, appropriate intervention could then be provided. Post-graduate courses offering training in reflex integration programmes would be the most cost-effective method of providing generic programmes, such as RMT. Gazca (2012) noted that with further reflex integration education, practitioners noticed greater changes in children using RMT. Training teachers would also enable them to be responsive to the needs of the group and to offer a greater range of movements than were used in this research. As has been reported in the findings of this research, RMT is easy to implement in a classroom and the engagement of children was high.

The range of challenges addressed through RMT positions it as a cost-effective, low-impact intervention that can be used in a generic way within a classroom. Researcher thinking has expanded in the usefulness of RMT and the possible implication of different approaches to its use. Could RMT be used in conjunction with other skill deficit-based programmes and is it possible that RMT may enhance the effectiveness of these interventions? Being able to give children with minor challenges access to an intervention is viewed as a strength of the generic use of RMT. Using the programme gives children opportunities to move physically, thus developing muscle strength and tone, while also having a quiet and possibly meditative moment during what can be a busy and noisy school day. Could RMT be used to develop music skills and how would this affect other achievement areas? This research has shown that completing the movements in a generic way for five months did not provide statistically significant differences between the intervention and control groups. However, when frequency of the movements was considered differences in the groups were observed. This implies that RMT may not be a ‘quick fix’ but that increased frequency produces positive results.

6.2 Thesis Conclusions

The New Zealand government’s National Curriculum (Ministry of Education, 2007) has a goal to provide the best educational opportunities available for children. Addressing achievement and behavioural challenges contribute to the achievement of that goal and require associated resourcing. It is possible that RMT could also contribute to the achievement of that goal as a

'bottom-up' intervention that enables the reduction of retained primitive reflexes and an increase in children's skills. Research shows that using reflex integration interventions in a generic manner requires a commitment of at least one year, and the ease with which RMT can be incorporated into the classroom setting would make engagement a realistic possibility.

Rhythmic Movement Training combines movement and rhythm, two aspects that have been identified as important components when enhancing children's development. It is based on the movements infants naturally make and this naturalistic approach focuses on the 'whole child'. The ability to use the movements in a child-directed manner has additional benefits for the child as they make decisions about which movements they would like to complete. RMT gains can be achieved without highlighting children's skill deficits which is important when the self-worth of the child is being nurtured. The number of children able to engage in the intervention is a strength of the generic use of RMT, meaning that children who would not qualify for state-funded interventions may have access to this intervention.

During this research, it was found that children were easy to engage in RMT and it was straightforward for professionals to learn the movements. It was flexible, with teachers able to decide when and how they used it in their classrooms. RMT was shown to be a cost-effective, low-impact intervention with potential to reduce a child's retention of primitive reflexes. This could in turn increase a child's ability to mature, thus addressing learning or behavioural challenges associated with maturity. In a world where increased specialisation is prevalent, RMT's generic approach to challenges was refreshing. RMT facilitated goals in the NZ Curriculum (Ministry of Education, 2007) and the programme was managed successfully within the physical space of the classroom. This research identified gains in reading and social and emotional skills while the children were using RMT four or more times each week. The conclusion of this research is that a small investment in RMT has potential positive gains for teachers and children.

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Appendices

The following list details the supporting documents for Tessa Grigg's PhD research.

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Appendix C	Information Sheet – Parent
Appendix Ca	Additional Information for Parents
Appendix D	Information talk – Children
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Appendix N	SDQ – Scoring system
Appendix O	RMT – Letter of Support
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Appendix Yb	Researcher's reply to ERHEC initial email
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Appendix Yd	Researcher's reply to ERHEC second email
Appendix Z	ERHEC Approval Letter

Appendix A

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Dear (Board of Trustees/ School Principal – school name here)

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Information Sheet for Board of Trustees/ School Principal

My name is Tessa Grigg and I am a registered teacher studying at the University of Canterbury. I would like to invite your school to participate in my research project as part of the completion of my PhD Thesis.

The aim of this project is to assess an intervention relating to retained infant reflexes and learning challenges. Further information about Rhythmic Movement Training (RMT) is available at <http://www.rhythmicmovement.com/>

School commitment:

The study will last 8 months - February 2017 testing. March 2017 - November 2017 intervention. I am the only researcher involved in the project and I would be seeking access to one Year 3 teacher and the children in that class.

Testing:

National Standards academic testing. I would be seeking access to the information from the tests, academic and behavioural, about the children to be used for the purposes of this study.

Each child will be asked to draw a picture of themselves three times during the year. This activity has been shown to highlight cognitive changes through the construction of the drawing.

Each child will be tested by me for the presence of three reflexes three times during the year. These tests are simple; e.g. holding their hands out in front and turning their head, and having the rounded end of a pen run down the back, either side of the spine while the child is in a crawling position. It will take approximately 5 minutes to test each child. The completion of each test will be video recorded so that accuracy of the testing can be checked.

On the completion of the tests, the class will be divided into two groups. One group will begin the exercises as soon as the study begins in March 2017. The second group will carry on with normal classroom activities for the 5 minutes that Group One is completing the exercises. After 4 months, in June 2017, the second group will begin the exercises along with the first group.

The exercises will be completed in the classroom each day with each session lasting approximately 3 -5 minutes. The risks associated with participating in the exercises are shown on the exercise menu sheet (attached). The teacher will monitor children and discuss any changes

with parents and/or me as the researcher. If the symptoms persist the child will cease the exercises for a short time.

The teacher will be asked to complete a simple one-page questionnaire twice during the year (Strengths and Difficulties Questionnaire (SDQ) attached) on each child. It will take approximately 5 minutes to complete for each child.

There will be one semi-formal interview with the teacher towards the end of the study. This will focus on the implementation of the programme within the classroom setting. The interview will last approximately 30 – 45 minutes. It will be recorded for transcribing purposes only.

Parent commitment:

Parents will be asked to complete a short questionnaire on-line twice during the year. One parent group interview will be held towards the end of the study. It will last approximately 1 hour. From the group of 'willing to participate' parents, 8 parents will be randomly selected to partake in the group interview.

General Information:

Participation is voluntary and your school has the right to withdraw at any stage without penalty. You may ask for raw data to be returned to you or destroyed at any point. If your school withdraws, I will remove information relating to your school. However, once analysis of raw data starts on 1 January 2018 it will become increasingly difficult to remove the influence of your school's data on the results. Data will not be collected from children with non-consenting parents.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, pseudonyms will be used for any interview material quoted. Children will not be interviewed or named in the study. The results of the project may be published, but identifiable information will not be used. All raw data will be held securely and kept for a minimum period of 10 years following completion of the project and then destroyed. A thesis is a public document and will be available through the UC Library.

Please indicate on the consent form if you would like to receive a copy of the summary of results of the project.

This research is being carried out to fulfil the requirements for my PhD under the supervision of: Prof Ian Culpan (tel: 03 369 3447 ext. 93 447, email: ian.culpan@canterbury.ac.nz) from the College of Education, Health and Human Development at the University of Canterbury. He will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it in the stamped addressed envelope attached, or email it to tessa.grigg@pg.canterbury.ac.nz

Yours sincerely,

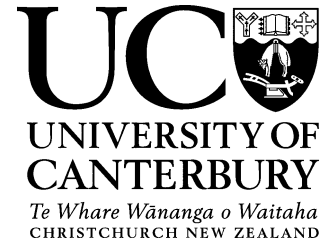


Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz

Appendix B

College of Education, Health and Human Development



Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz

1 November 2016

Dear (Teacher – name here)

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Information Sheet for Teacher

My name is Tessa Grigg and I am a registered teacher studying at the University of Canterbury. I would like to invite you to participate in my research project as part of the completion of my PhD Thesis.

The aim of this project is to assess an intervention relating to retained infant reflexes and learning challenges. Further information about Rhythmic Movement Training (RMT) is available at <http://www.rhythmicmovement.com/>

Teacher commitment:

The study will last 8 months - February 2017 testing. March 2017 - November 2017 intervention. I am the only researcher involved in the project and I would be seeking access to the Year 3 children in your class.

Testing:

National Standards academic testing. I would be seeking access to information from academic testing, and any behavioural notes you have made about the children, for the purposes of this study.

Each child will be asked to draw a picture of themselves three times during the year. This activity has been shown to highlight cognitive changes through the construction of the drawing.

Each child will be tested by me for the presence of three reflexes three times during the year. These tests are simple; e.g. holding their hands out in front and turning their head, and having the rounded end of a pen run down the back, either side of the spine while the child is in a crawling position. It will take approximately 5 minutes to test each child. The completion of each test will be video recorded so that reliability of the testing can be checked.

On the completion of the tests, the class will be divided into two evenly matched groups. One group will begin the exercises as soon as the study begins in March 2017. The second group will carry on with normal classroom activities while Group One is completing the exercises. After 4 months, in June 2017, the second group will begin the exercises along with the first group. The exercises will be completed in the classroom each day with each session lasting approximately 3 -5 minutes. The risks associated with participating in the exercises are shown on the exercise menu sheet (attached). You will monitor children and discuss any changes with

parents and/or me as the researcher. If symptoms persist the child will stop the exercises for a short time.

You will be asked to complete a simple one-page questionnaire twice during the year (Strengths and Difficulties Questionnaire (SDQ) attached) on each child. It will take approximately 5 minutes to complete for each child.

There will be one semi-formal interview with you towards the end of the study. This will focus on the implementation of the programme within the classroom. The interview will last approximately 30 – 45 minutes. It will be recorded for transcribing purposes only.

Parent commitment:

Parents will be asked to complete a short questionnaire on-line or paper based twice during the year. It will take approximately 10 minutes to complete.

One parent group interview will be held towards the end of the study. It will last approximately 1 hour. From the group of 'willing to participate' parents, 8 parents will be randomly selected to partake in the group interview.

General Information:

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 1 January 2018 it will become increasingly difficult to remove the influence of your data on the results. Data will not be collected from children with non-consenting parents.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, pseudonyms will be used for any interview material quoted. Children will not be interviewed or named in the study. The results of the project may be published, but identifiable information will not be used. All raw data will be held securely and kept for a minimum period of 10 years following completion of the project and then destroyed. A thesis is a public document and will be available through the UC Library.

Please indicate on the consent form if you would like to receive a copy of the summary of results of the project.

This research is being carried out to fulfil the requirements for my PhD under the supervision of: Prof Ian Culpan (tel: 03 369 3447 ext. 93 447, email: ian.culpan@canterbury.ac.nz) from the College of Education, Health and Human Development at the University of Canterbury. He will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it in the stamped addressed envelope attached, or email it to tessa.grigg@pg.canterbury.ac.nz

Yours sincerely,

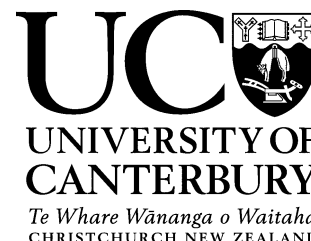


Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

Appendix C

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



16 February 2017

Dear Parents/Caregivers

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Information Sheet for Parents/Caregivers

My name is Tessa Grigg and I am a registered teacher studying at the University of Canterbury. I would like to invite you to participate in my research project as part of the completion of my PhD.

The aim of this project is to assess an intervention relating to retained infant reflexes and learning and behavioural challenges. Further information about Rhythmic Movement Training (RMT) is available at <http://www.rhythmicmovement.com/>

Parent commitment:

You will be asked to complete a short questionnaire on-line or on paper twice during the year. It will take approximately 10 minutes to complete.

One parent group interview will be held towards the end of the study. It will last approximately 1 hour. From the group of 'willing to participate' parents, 8 parents will be randomly selected to partake in the group interview.

School commitment and data gathering:

The study will last 8 months - February 2017 testing. March 2017 - November 2017 intervention.

National Standards academic testing. I will be seeking access to information, academic and behavioural, about your child to be used for the purposes of this study.

Each child will be asked to draw a picture of themselves three times during the year. This activity has been shown to highlight changes in brain development through the construction of the drawing.

Each child will be tested by me for the presence of three reflexes three times during the year. These tests are simple; e.g. holding their hands out in front and turning their head, and having the rounded end of a pen run down the back, either side of the spine while the child is in a crawling position. It will take approximately 5 minutes to test each child. The completion of each test will be video recorded so that reliability of the testing can be checked.

On the completion of the tests, the class will be divided into two evenly matched groups. One group will begin the exercises as soon as the study begins in March 2017. The second group will

carry on with normal classroom while Group One is completing the exercises. After 4 months, in June 2017, the second group will begin the exercises along with the first group. The exercises will be completed in the classroom each day with each session lasting approximately 3 -5 minutes. The risks associated with participating in the exercises are shown on the exercise menu sheet (attached). The teacher will monitor children and discuss any changes with you and/or me as the researcher. If the symptoms persist the child will cease the exercises for a short time.

General Information:

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you and your child. However, once analysis of raw data starts on 1 January 2018 it will become increasingly difficult to remove the influence of your data on the results. Data will not be collected from children with non-consenting parents.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure anonymity and confidentiality, pseudonyms will be used for any interview material quoted. Children will not be interviewed or named in the study. The results of the project may be published, but identifiable information will not be used. All raw data will be held securely and kept for a minimum period of 10 years following completion of the project and then destroyed. A thesis is a public document and will be available through the UC Library.

Please indicate on the consent form if you would like to receive a copy of the summary of results of the project.

This research is being carried out to fulfil the requirements for my PhD under the supervision of: Prof Ian Culpan (tel: 03 369 3447 ext. 93 447, email: ian.culpan@canterbury.ac.nz) from the College of Education, Health and Human Development at the University of Canterbury. He will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it in the stamped addressed envelope attached, or email it to tessa.grigg@pg.canterbury.ac.nz

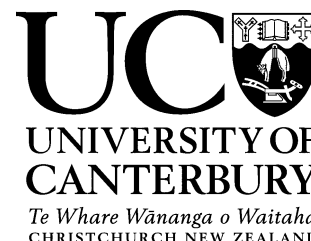
Yours sincerely,



Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

Appendix Ca

College of Education, Health and Human Development



Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz

16 March 2017

Dear Parents and Caregivers

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Additional Information Sheet Following parent meetings:

I have met with parents over the last few weeks and the following questions have been asked:

Q: Why are you wanting the children to do the exercises?

A: I want to see if there is an improvement in the reading, writing and maths of children who do the exercises. It is also possible that there could be changes in other skills, such as having better focus, being able to sit still, improved co-ordination, or better relationships with other children. I want to test these possibilities. This week I have been testing children in another school and the results of these Year 3 'quake' babies shows that the stress around the time of their birth has increased the possibility that their reflexes have not gone away as would be expected. I am hoping to help these children.

Q: Will my child be singled out?

A: No. The children do the exercises as a group. I already have a whole class doing the exercises in a school, and it is just like a little sport or exercise time. There is no competition as to who is the best, fastest etc.

Q: Will anyone know my child has been in the study.

A: No – unless you tell them. No child will be written about individually. They will be given a number, and all the information about them is attached to that number.

This information is in addition to the original information sheet.

If you agree to participate in the study, you are asked to complete the consent form and return it to the school, or you can email me directly for an electronic version of the consent form.

Yours sincerely,

Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

Appendix D

College of Education, Health and Human Development

Tel: 027 477 4825

Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Class Talk – Topics to be covered by the Teacher

My name is Tessa and I am at University studying

I am looking at what happens when children do some exercises.

You will complete some tests. You will need to draw a picture of yourself. You will also need to do some simple exercises. I will video you doing this so that I can check that I am doing my job correctly. The video will not be used anywhere else.

I will show you and your teacher how to do the exercises.

When you know some of the exercises you will be able to choose which ones you do.

I will not be telling anyone that you are in the study. But you can tell people that you are part of a study if you want to.

When I write about what I found out, I will not use your names.

If you have any questions you can ask your teacher or your parent/caregiver and they will ask me.

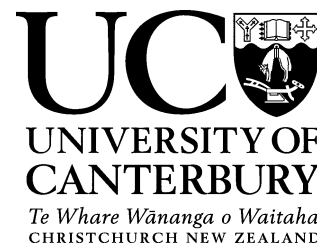
Does anyone have any questions now?

The teacher will read this to the children before they are asked to sign the consent forms.

Appendix E

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Consent Form for Principal/ Board of Trustees

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of our school if I agree to take part in the research.
- ☐ I understand that participation is voluntary and our school may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information we have provided should this remain practically achievable.
- ☐ I understand that any information or opinions provided will be kept confidential to the researcher and her supervisors and that any published or reported results will not identify the participants or school. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and in password protected electronic form and will be destroyed after ten years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that if I require further information I can contact the researcher, Tessa Grigg (tessa.grigg@pg.canterbury.ac.nz) or her supervisor, Prof Ian Culpan (tel: 03 369 3447 ext. 93 447 email: ian.culpan@canterbury.ac.nz). If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).
- ☐ I would like a summary of the results of the project.

- ☐ By signing below, I agree to participate in this research project.

Name: _____

Designation _____

Signature: _____ Date: _____

Email address: _____

Please post this document (stamped addressed envelope included) to:

Tessa Grigg – Post Graduate Studies
C/o Professor Ian Culpan
College of Education, Health and Human Development
University of Canterbury
Private Bag 4800
Christchurch 8041

Or scan and email to tessa.grigg@pg.canterbury.ac.nz

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



15 December 2016

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Consent Form for Teacher – XXXXX School

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher and her supervisors and that any published or reported results will not identify the participants or school. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and in password protected electronic form and will be destroyed after ten years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that if I require further information I can contact the researcher, Tessa Grigg (tessa.grigg@pg.canterbury.ac.nz) or her supervisor, Prof Ian Culpan (tel: 03 369 3447 ext. 93 447 email: ian.culpan@canterbury.ac.nz). If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name: _____

Designation _____

Signature: _____ Date: _____

Email address: _____

Please post this document (stamped addressed envelope included) to:

Tessa Grigg – Post Graduate Studies
C/o Professor Ian Culpan
College of Education, Health and Human Development
University of Canterbury
Private Bag 4800
Christchurch 8041

Or fill in this form and return by email, or print, scan and email to
tessa.grigg@pg.canterbury.ac.nz

Appendix G

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Project Title: *What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?*

Consent Form for Parents

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher and her supervisors and that any published or reported results will not identify the participants or school. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and in password protected electronic form and will be destroyed after ten years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that if I require further information I can contact the researcher, Tessa Grigg (tessa.grigg@pg.canterbury.ac.nz) or her supervisor, Prof Ian Culpan (tel: 03 369 3447 ext. 93 447 email: ian.culpan@canterbury.ac.nz). If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).
- ☐ I would like a summary of the results of the project.

- ☐ By signing below, I agree to participate in this research project.

Name: _____

Designation _____

Signature: _____ Date: _____

Email address: _____

Please post this document (stamped addressed envelope included) to:

Tessa Grigg – Post Graduate Studies
C/o Professor Ian Culpan
College of Education, Health and Human Development
University of Canterbury
Private Bag 4800
Christchurch 8041

Or scan and email to tessa.grigg@pg.canterbury.ac.nz

Appendix H

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Research Title: *What influences does the use of Rhythmic Movement Training (RMT) have on students?*

Consent Information Form for Children

I agree to be part of this study and I agree with these sentences below:

- ☐ I have had the project explained to me.
- ☐ I understand that I will do some simple tests with Tessa and that these will be videoed.
- ☐ I understand that my real name will not be used.

Name: _____

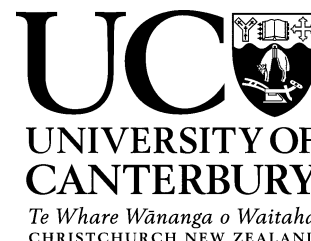
Signature: _____ Date: _____

Return this form: Please give this form to your teacher to return to Tessa Grigg

Appendix I

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Parent Semi-Formal Interview

Research Title: What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?

The questions below will form the basis of the semi-formal interview to be conducted with parents. The aim of the questions is to create a starting point from which to gather comprehensive qualitative data. Additional supplementary questions may arise through the focus-group interview process.

Suggested topics for discussion:

**How has the year been for your children as they have participated in the study?
Give examples where possible.**

**How has it been for your child to complete the RMT exercises at school? Give
examples of comments they have made.**

**What are your perceptions of changes in your child's behaviour this year? Give
examples of specific aspects relating to self-regulation, resilience and peer-
relations you may have noticed.**

**What are your perceptions of your child's the academic achievements this year?
Give specific examples you have noticed.**

**Have there been expected (positive or negative) outcomes for your child this year?
Give specific examples.**

**Have there been any unexpected (positive or negative) outcomes for your child this
year? Give specific examples.**

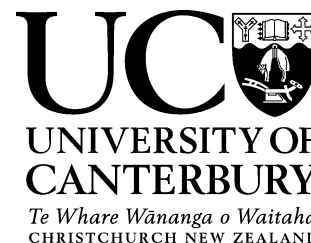
Have you encountered any barriers to participation in the RMT intervention?

**Can you provide information about your child's delivery/birth? Was there any
relationship to the earthquakes?**

Appendix J

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



1 November 2016

Teacher Semi-Formal Interview

Research Title:

What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?

The questions below will form the basis of the semi-formal interview to be conducted with the teacher. The aim of the questions is to create a starting point in which to gather comprehensive qualitative data. Additional supplementary questions may arise through the interview process.

Suggested questions for the teacher:

**How has the year been for your children as they have participated in the study?
Give examples if possible.**

How has it been for the children in the class to complete the RMT exercises? Give specific examples where possible.

What are your overall perceptions about the children's behavioural outcomes this year? Give examples of social and emotional changes you have noticed within the class.

What are your overall perceptions about the academic achievements the children have made this year? Give specific examples.

Have there been expected outcomes (negative or positive) for the class this year? Give examples of these outcomes.

Have there been any unexpected outcomes (negative or positive) for the class this year? Give examples.

Appendix K

Strengths and Difficulties Questionnaire

P 4-17

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months.

Child's Name

Male/Female

Date of Birth.....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restless, overactive, cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Often complains of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shares readily with other children (treats, toys, pencils etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often has temper tantrums or hot tempers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rather solitary, tends to play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally obedient, usually does what adults request	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many worries, often seems worried	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has at least one good friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often fights with other children or bullies them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally liked by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Easily distracted, concentration wanders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervous or clingy in new situations, easily loses confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often lies or cheats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Picked on or bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often volunteers to help others (parents, teachers, other children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thinks things out before acting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steals from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gets on better with adults than with other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many fears, easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sees tasks through to the end, good attention span	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you have any other comments or concerns?

Appendix L

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



17 May 2017

Dear Parents/Caregivers

Strengths and Difficulties Questionnaire – SDQ

Thank you for agreeing to take part in my research project. I appreciate your support.

As part of my data gathering, I am at the stage where I need you to complete the attached questionnaire. You are also able to complete this on-line at if you wish. [UC Research RMT Questionnaire– Researcher Tessa Grigg. Click here](#)

The questionnaire will take between 5 and 10 minutes to complete. Most answers are as a check-box, but there is a place to write more about your child if you would like to.

Please return the completed paper questionnaires to the School Office and I will collect them.

Confidentiality will be maintained. This information will not be shared with the teacher

Please complete the on-line questionnaire by 1st June or return the paper questionnaire to the School Office by 1st June.

If you have any questions about this project, please do not hesitate to contact me:
tessa.grigg@pg.canterbury.ac.nz .

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Grigg'.

Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

Appendix M

College of Education, Health and Human Development

Tel: 027 477 4825
Email: tessa.grigg@pg.canterbury.ac.nz



15 February 2017

Dear Teacher

Strengths and Difficulties Questionnaire – SDQ

Thank you for agreeing to take part in my research project. I appreciate your support.

As part of my data gathering, I am at the stage where I need you to complete the attached questionnaire for each child in your class. You are also able to complete this on-line at www.tessa'squestionnaire.ac.nz if you wish.

The questionnaire will take between 5 and 10 minutes to complete. Most answers are as a check-box, but there is a place to write more about the child if you would like to.

Confidentiality will be maintained.

Please return the completed questionnaires to the School Office by 1st March 2017. To ensure the reliability of the data being gathered these questionnaires need to be completed before the intervention can begin.

If you have any questions about this project, please do not hesitate to contact me:
tessa.grigg@pg.canterbury.ac.nz .

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Grigg'.

Tessa M Grigg,
M Ed, Dip Tch Primary and ECE

Appendix N

20 June 2016

1

Scoring the Strengths & Difficulties Questionnaire for age 4-17 or 18+

The 25 items in the SDQ comprise 5 scales of 5 items each. It is usually easiest to score all 5 scales first before working out the total difficulties score. 'Somewhat True' is always scored as 1, but the scoring of 'Not True' and 'Certainly True' varies with the item, as shown below scale by scale. For each of the 5 scales the score can range from 0 to 10 if all items were completed. These scores can be scaled up pro-rata if at least 3 items were completed, e.g. a score of 4 based on 3 completed items can be scaled up to a score of 7 (6.67 rounded up) for 5 items.

Note that the items listed below are for 4-17-year-olds, but the scoring instructions are identical for the similarly-worded '18+' SDQ

Table 1: Scoring symptom scores on the SDQ for 4-17 year olds

	Not True	Somewhat True	Certainly True
Emotional problems scale			
ITEM 3: Often complains of headaches... <i>(I get a lot of headaches...)</i>	0	1	2
ITEM 8: Many worries... <i>(I worry a lot)</i>	0	1	2
ITEM 13: Often unhappy, downhearted... <i>(I am often unhappy...)</i>	0	1	2
ITEM 16: Nervous or clingy in new situations... <i>(I am nervous in new situations...)</i>	0	1	2
ITEM 24: Many fears, easily scared <i>(I have many fears...)</i>	0	1	2
Conduct problems Scale			
ITEM 5: Often has temper tantrums or hot tempers <i>(I get very angry)</i>	0	1	2
ITEM 7: Generally obedient... <i>(I usually do as I am told)</i>	2	1	0
ITEM 12: Often fights with other children... <i>(I fight a lot)</i>	0	1	2
ITEM 18: Often lies or cheats <i>(I am often accused of lying or cheating)</i>	0	1	2
ITEM 22: Steals from home, school or elsewhere <i>(I take things that are not mine)</i>	0	1	2
Hyperactivity scale			
ITEM 2: Restless, overactive... <i>(I am restless...)</i>	0	1	2
ITEM 10: Constantly fidgeting or squirming <i>(I am constantly fidgeting...)</i>	0	1	2
ITEM 15: Easily distracted, concentration wanders <i>(I am easily distracted)</i>	0	1	2
ITEM 21: Thinks things out before acting <i>(I think before I do things)</i>	2	1	0
ITEM 25: Sees tasks through to the end... <i>(I finish the work I am doing)</i>	2	1	0
Peer problems scale			
ITEM 6: Rather solitary, tends to play alone <i>(I am usually on my own)</i>	0	1	2
ITEM 11: Has at least one good friend <i>(I have one good friend or more)</i>	2	1	0
ITEM 14: Generally liked by other children <i>(Other people my age generally like me)</i>	2	1	0
ITEM 19: Picked on or bullied by other children... <i>(Other children or young people pick on me)</i>	0	1	2
ITEM 23: Gets on better with adults than with other children <i>(I get on better with adults than with people my age)</i>	0	1	2
Prosocial scale			
ITEM 1: Considerate of other people's feelings <i>(I try to be nice to other people)</i>	0	1	2
ITEM 4: Shares readily with other children... <i>(I usually share with others)</i>	0	1	2
ITEM 9: Helpful if someone is hurt... <i>(I am helpful if someone is hurt...)</i>	0	1	2
ITEM 17: Kind to younger children <i>(I am kind to younger children)</i>	0	1	2
ITEM 20: Often volunteers to help others... <i>(I often volunteer to help others)</i>	0	1	2

Total difficulties score: This is generated by summing scores from all the scales except the prosocial scale. The resultant score ranges from 0 to 40, and is counted as missing if one of the 4 component scores is missing.

'Externalising' and 'internalising' scores: The externalising score ranges from 0 to 20 and is the sum of the conduct and hyperactivity scales. The internalising score ranges from 0 to 20 and is the sum of the emotional and peer problems scales. Using these two amalgamated scales may be preferable to using the four separate scales in community samples, whereas using the four separate scales may add more value in high-risk samples (see Goodman & Goodman, 2009 *Strengths and difficulties questionnaire as a dimensional measure of child mental health. J Am Acad Child Adolesc Psychiatry* 48(4), 400-403).

Generating impact scores

When using a version of the SDQ that includes an 'impact supplement', the items on overall distress and impairment can be summed to generate an impact score that ranges from 0 to 10 for parent- and self-report, and from 0 to 6 for teacher-report.

Table 2: Scoring the SDQ impact supplement

	Not at all	Only a little	A medium amount	A great deal
<u>Parent report:</u>				
Difficulties upset or distress child	0	0	1	2
Interfere with HOME LIFE	0	0	1	2
Interfere with FRIENDSHIPS	0	0	1	2
Interfere with CLASSROOM LEARNING	0	0	1	2
Interfere with LEISURE ACTIVITIES	0	0	1	2
<u>Teacher report:</u>				
Difficulties upset or distress child	0	0	1	2
Interfere with PEER RELATIONS	0	0	1	2
Interfere with CLASSROOM LEARNING	0	0	1	2
<u>Self-report report:</u>				
Difficulties upset or distress child	0	0	1	2
Interfere with HOME LIFE	0	0	1	2
Interfere with FRIENDSHIPS	0	0	1	2
Interfere with CLASSROOM LEARNING	0	0	1	2
Interfere with LEISURE ACTIVITIES	0	0	1	2

Responses to the questions on chronicity and burden to others are not included in the impact score. When respondents have answered 'no' to the first question on the impact supplement (i.e. when they do not perceive themselves as having any emotional or behavioural difficulties), they are not asked to complete the questions on resultant distress or impairment; the impact score is automatically scored zero in these circumstances.

Cut-points for SDQ scores for age 4-17: original 3-band solution & newer 4-band solution

Although SDQ scores can be used as continuous variables, it is sometimes convenient to categorise scores. The initial bandings presented for the SDQ scores were 'normal', 'borderline' and 'abnormal'. These bandings were defined based on a population-based UK survey, attempting to choose cutpoints such that 80% of children scored 'normal', 10% 'borderline' and 10% 'abnormal'.

More recently a four-fold classification has been created based on an even larger UK community sample. This four-fold classification differs from the original in that it (1) divided the top 'abnormal' category into two groups, each containing around 5% of the population, (2) renamed the four categories (80% 'close to average', 10% 'slightly raised', 5% 'high' and 5% 'very high' for all scales except prosocial, which is 80% 'close to average', 10% 'slightly lowered', 5% 'low' and 5% 'very low'), and (3) changed the cut-points for some scales, to better reflect the proportion of children in each category in the larger dataset.

Note that these cut points have not been validated for use with the 18+ SDQ, so we suggest that it is safest to use continuous scores rather than categories for this measure

Table 3: Categorising SDQ scores for 4-17 year olds (not validated for 18+)

	Original 3-band categorisation			Newer 4-band categorisation			
	Normal	Borderline	Abnormal	Close to average	Slightly raised (/slightly lowered)	High (/Low)	Very high (very low)
<u>Parent completed SDQ</u>							
Total difficulties score	0-13	14-16	17-40	0-13	14-16	17-19	20-40
Emotional problems score	0-3	4	5-10	0-3	4	5-6	7-10
Conduct problems score	0-2	3	4-10	0-2	3	4-5	6-10
Hyperactivity score	0-5	6	7-10	0-5	6-7	8	9-10
Peer problems score	0-2	3	4-10	0-2	3	4	5-10
Prosocial score	6-10	5	0-4	8-10	7	6	0-5
Impact score	0	1	2-10	0	1	2	3-10
<u>Teacher completed SDQ</u>							
Total difficulties score	0-11	12-15	16-40	0-11	12-15	16-18	19-40
Emotional problems score	0-4	5	6-10	0-3	4	5	6-10
Conduct problems score	0-2	3	4-10	0-2	3	4	5-10
Hyperactivity score	0-5	6	7-10	0-5	6-7	8	9-10
Peer problems score	0-3	4	5-10	0-2	3-4	5	6-10
Prosocial score	6-10	5	0-4	6-10	5	4	0-3
Impact score	0	1	2-6	0	1	2	3-6
<u>Self-completed SDQ</u>							
Total difficulties score	0-15	16-19	20-40	0-14	15-17	18-19	20-40
Emotional problems score	0-5	6	7-10	0-4	5	6	7-10
Conduct problems score	0-3	4	5-10	0-3	4	5	6-10
Hyperactivity score	0-5	6	7-10	0-5	6	7	8-10
Peer problems score	0-3	4-5	6-10	0-2	3	4	5-10
Prosocial score	6-10	5	0-4	7-10	6	5	0-4
Impact score	0	1	2-10	0	1	2	3-10

Note that both these systems only provide a rough-and-ready way of screening for disorders; combining information from SDQ symptom and impact scores from multiple informants is better, but still far from perfect.

Appendix O

Moira Dempsey
305A/158 Albert St
East Melbourne Vic 3002
Australia
+61-423-659754
moira2312@gmail.com

30 September, 2016

TO WHOM IT MAY CONCERN

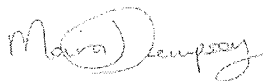
Re: PhD Research Proposal - Tessa Grigg

It is my understanding that Tessa Grigg is about to undertake a PhD with the working title of: *Does Rhythmic Movement Training improve educational and/or behavioural outcomes for children?*

I was very pleased and excited when I heard that Tessa was continuing her studies and is expanding her research focus into the possible effects of RMT (Rhythmic Movement Training) for children. My sincere wish for many years has been that genuine independent studies are undertaken that that may lead to the scientific support of the observational and anecdotal experiences of the many people that have used this programme.

I give my full support to Tessa's undertaking and I will be very interested in finding out about the results at the end of the study.

Yours sincerely



Moira Dempsey
Co-Founder & Developer
Rhythmic Movement Training (RMT)

Appendix P

Your RMT Menu

Name: Year 3 Set 1

Responses and Reactions to RMT

RMT has many positive benefits for the people who do the movements on a regular and consistent basis. However it is possible to experience physical and /or emotional reactions to the activities—this is one reason that it is important not to do too much when you, or your child, first start the program.

Physical reactions include:

- Flatulence
- Nausea
- Diarrhoea
- Skin rashes
- Itching
- Fever
- Colds
- Swollen eyes
- Headaches
- Fatigue
- Weakness
- Cough up phlegm

Emotional reactions include:

- Periods of defiance
- Demanding and very babyish
- Want to sit in lap and be mothered
- Afraid to sleep alone
- Nightmares
- Difficulties falling asleep
- Go through defiant stage/terrible twos

These responses are actually positive, as they show that the movements are creating neural connections, improving muscle tone and posture and integrating the primitive reflexes. So please don't stop the movements, keep at least one going while the system adjusts to the new integration and abilities.

2014©Moira Dempsey www.rhythmicmovement.com

Responses and Reactions to RMT

We advise that you contact your medical physician if you have any concerns about the RMT program.

Please contact your RMTi provider if you have any questions about the program that has been devised for you.

If necessary please contact the RMTi office at info@rhythmicmovement.com

2014©Moira Dempsey www.rhythmicmovement.com

Sliding on the Back – Active



Lie on your back with the knees bent and slide your back along the floor. The whole body needs to be involved in the movement from the feet up to the top of the head and back again. The neck should be relaxed and the head nod in time with the rest of the body.

Ideally the back should be flat against the floor, if this is difficult you can place a rolled up towel or small cushion under the small of the back.

If you feel dizzy, disoriented or nauseous stop the movement.

It is okay to close your eyes if this is easier. You can also focus on a spot on the ceiling this often helps overcome dizziness.

In the beginning you may only be able to do this for a very short period of time (e.g. 10 or 20 seconds), this can soon build up to 2 minutes or more. It is better to start with a little and slowly add time than to do too much in the beginning.

An alternative is to rest the heels on a small cushion or rolled up towel and generate the movement more from the toes. This is especially useful if you are clumsy.



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Bottom Rolling - Active



To do this movement by yourself, lay face down and roll your bottom side to side. You can make it a small movement or a large movement. Do not raise your hips off the floor. The movement ideally involves the entire lumbar / lower spine, and should be symmetrical.

Go at the speed you like, there is no right speed. You can alternate speeds if you like.

You need to keep your head and shoulders still and relaxed. If you find this difficult you can place a small cushion under your chest.

The feet need to be turned in and relaxed. The ankles should rest on the floor. If this is difficult you can rest your feet on a cushion - this also can help to relax your lower back.



Caution - This movement can produce a lot of mucus so take care if you have asthma or if doing it with people with asthma.

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STNR Rocking



Sit back on your heels with arms stretched out in front. Bounce forward and back. Keep this movement going.

The arms need to stay relaxed, the spine straight, the hands flat on the floor and the head straight and relaxed.

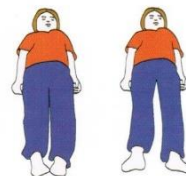
The movement is meant to be rhythmical, smooth and fun. For a bigger movement move your hands further away from the knees, for a smaller movement bring them closer.

Work up to being able maintain the movement for two minutes. This movement builds strength and muscle tone in the arms and spine, and when you first start it can be difficult to maintain.

Remember to keep breathing while doing the movement.

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A. Windscreen Wiper



Child lies on his back with legs straight. He rotates his legs in and the toes touch in the middle then he rotates them out so that the feet touch the floor. The child keeps this movement going in as rhythmical and even way as possible.

You can count to help the child maintain a rhythm. E.g. 1 - 2 - 3, 1 - 2 - 3, 1 - 2 - 3

This movement is a whole leg movement, with the movement actually originating in the hip region. The child can place their hands on their hips to help them feel the movement.

If only the feet are moving and not the whole leg you can assist the movement by holding the child's legs above the ankles and help him to make it a whole leg movement. Rhythmically move the legs in and out.

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Appendix Q

Your RMT Menu

Name: Year 3 additional movement

Responses and Reactions to RMT

RMT has many positive benefits for the people who do the movements on a regular and consistent basis. However it is possible to experience physical and / or emotional reactions to the activities – this is one reason that it is important not to do too much when you, or your child, first start the program.

Physical reactions include:

- Flatulence
- Nausea
- Diarrhoea
- Skin rashes
- Itching
- Fever
- Colds
- Swollen eyes
- Headaches
- Fatigue
- Weakness
- Cough up phlegm

Emotional reactions include:

- Periods of defiance
- Demanding and very babyish
- Want to sit in lap and be mothered
- Afraid to sleep alone
- Nightmares
- Difficulties falling asleep
- Go through defiant stage/terrible twos

These responses are actually positive, as they show that the movements are creating neural connections, improving muscle tone and posture and integrating the primitive reflexes. So please don't stop the movements, keep at least one going while the system adjusts to the new integration and abilities.

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Responses and Reactions to RMT

We advise that you contact your medical physician if you have any concerns about the RMT program.

Please contact your RMTi provider if you have any questions about the program that has been devised for you.

If necessary please contact the RMTi office at info@rhythmicmovement.com

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3. Chest Thump (Tarzan)



Hit the mid-area of the chest with either the fist or flat hand.

You can use one hand or two – either hitting together, or alternating.

It is best if the person does it themselves, then they can be in charge of the pressure and tempo needed.

Appendix R



GOODENOUGH DRAW – A – PERSON TEST

DIRECTIONS: “I want you to make a picture of a person. Make the very best picture that you can. Take your time and work very carefully. Try very hard and see what a good picture you can make.”

TIME:	No time limit. Usually 10 minutes will suffice with young children. This test is to be used primarily as a screening device. The drawings of bright children more than 10 years old or those who have had drawing lessons will result in an invalid evaluation of the child’s intellectual potential.
	SCORING
<u>CLASS A</u>	Preliminary Stage in which the drawing cannot be recognized as a human figure: 1. Aimless uncontrolled scribbling – score 0. 2. Lines somewhat controlled – approaches crude geometrical form – score 1.
<u>CLASS B</u>	All drawings that can be recognized as attempts to represent the human figure. Each point is scored plus or minus. One credit for each point scored plus and no half credits given.
GROSS DETAIL	1. Head present 2. Legs present. 3. Arms present 4. Trunk present 5. Length of trunk greater than breadth. 6. Shoulders are indicated (abrupt broadening of trunk below neck)
ATTACHMENTS	1. Both arms and legs attached to trunk. 2. Arms and legs attached to trunk at correct points. 3. Neck present. 4. Outline of neck continuous with that of head, trunk, or both.
HEAD DETAIL	1. Eyes present (one or two) 2. Nose present 3. Mouth present 4. Nose and mouth in two dimensions, two lips shown. 5. Nostril shown 6. Hair shown 7. Hair on more than circumference of head and non-transparent – better than a scribble.
CLOTHING	1. Clothing present (any clear representation of clothing) 2. Two articles of clothing non transparent (ex. Hat, trousers) 3. Entire drawing free from transparencies – sleeves and trousers must be shown. 4. Four articles of clothing definitely indicated. *should include 4 – hat, shoes, coat, shirt, necktie, belt, trousers* 5. Costume complete with incongruities *business suit, soldier’s costume and hat, sleeves trousers and shoes must be shown*
HAND DETAIL	1. Fingers present (any indication) 2. Correct number of fingers shown 3. Fingers in two dimensions – length greater than breadth, angle subtended not greater than 180 degrees 4. Opposition of thumb clearly defined 5. Hand shown distinct from fingers and arm

JOINTS

1. Arm joint shown – elbow, shoulder, or both
2. leg joint shown – knee, hip, or both

PROPORTION

1. Head not more than $\frac{1}{2}$ or less than $\frac{1}{10}$ of trunk
2. Arms equal to trunk but not reaching knee
3. Legs not less than trunk not more than twice trunk size
4. Feet in 2 dimensions – not more than $\frac{1}{3}$ or less than $\frac{1}{10}$ of leg
5. Both arms and legs in two dimensions

MOTOR COORDINATION

1. Lines firm without marked tendency to cross, gap, or overlap.
2. All lines firm with correct joining.
3. Outline of head without obvious irregularities. Develop beyond first crude circle. Conscious control apparent.
4. Trunk outline. Score same as #3.
5. Arms and legs without irregularities. 2 dimensions and no tendency to narrow at point of junction with trunk.
6. Features symmetrical (more likely to credit in profile drawings)

FINE HEAD DETAIL

1. Ears present (2 in full face, 1 in profile)
2. Ears present in correct position and proportion.
3. Eye details – brow or lashes shown.
4. Eye detail – pupil shown.
5. Eye detail – proportion. Length greater than width.
6. Eye detail – glance – only plus in profile.
7. Chin and forehead shown.

PROFILE

1. Projection of chin shown – usually + in profile.
2. heel clearly shown
3. Body profile – head, trunk, and feet without error.
4. Figure shown in true profile without error or transparency.

TABLE OF MENTAL AGE EQUIVALENTS OF SCORES

SCORE	MA	SCORE	MA	SCORE	MA	SCORE	MA
1	3-3	14	6-6	27	9-9	40	13-0
2	3-6	15	6-9	28	10-0	41	13-3
3	3-9	16	7-0	29	10-3	42	13-6
4	4-0	17	7-3	30	10-6	43	13-9
5	4-3	18	7-6	31	10-9	44	14-0
6	4-6	19	7-9	32	11-0	45	14-3
7	4-9	20	8-0	33	11-3	46	14-6
8	5-	21	8-3	34	11-6	47	14-9
9	5-3	22	8-6	35	11-9	48	15-0
10	5-6	23	8-9	36	12-0	49	15-3
11	5-9	24	9-0	37	12-3	50	15-6
12	6-0	25	9-3	38	12-6	51	15-9
13	6-3	26	9-6	39	12-9		

IN FINDING THE IQ OF RETARDED CHILDREN WHO ARE MORE THAN 13 YEARS OLD, THE CHRONOLOGICAL AGE SHOULD BE TREATED AS 13 ONLY, AND THE IQ RECORDED AS “OR BELOW.”

IT IS NOT WISE TO ATTEMPT TO USE THIS TEST WITH BRIGHT CHILDREN OF MORE THAN 12 YEARS OF AGE.

Appendix S

Reflex Testing Procedures – Tessa Grigg PhD Research

ATNR:

Test: The child holds their arms extended at shoulder height, feet together and eyes closed. The child is then asked to turn their head slowly to one side and then to the other. Arm movement and balance are assessed (Goddard, 1996; Konicarova & Bob, 2013).

Scoring:

- 0: No response
- 1: Slight movement of the arms in the direction the face is pointed
- 2: Movement of the arms in the direction of the head to 45 deg
- 3: Arm movement to 60 deg
- 4: 90 deg rotation of the arms and/or loss of balance (Goddard, 1996)

Spinal Galant:

Test: Child kneels on all fours. Stroke the child's back with the blunt end of a pen from the ribs to the hip, either side of the spine, individually and then together. Watch for hip rotation or swivel, and shoulder movement (Blomberg & Dempsey, 2011; Goddard, 1996).

Scoring:

- 0: No response
- 1: Undulation or movement of the hip towards 15 deg
- 2: Undulation or movement of the hip towards 30 deg
- 3: Undulation or movement of the hip towards 45 deg
- 4: Movement outwards, beyond 45 deg and this may affect the child's balance (Goddard, 1996)

Tonic Labyrinthine Neck Reflex:

Test: Child stands with feet together. Then complete the following;

Bend head forward with eyes open, then eyes closed.

Bend head back with eyes open, then with eyes closed.

Notice any wobbling, dizziness or disorientation. Toes may be raised, or there may be tension in neck, shoulders or legs (Blomberg & Dempsey, 2011; Goddard, 1996).

- 0: No response
- 1: Slight alteration of balance because of head position or movement
- 2: Disturbance of balance during test and/or alteration of muscle tone at back of knee
- 3: Near loss of balance, alteration of muscle tone and/or disorientation because of test
- 4: Loss of balance and/or massive alteration of muscle tone in an attempt to maintain balance. This may be accompanied by dizziness or nausea (Goddard, 1996).

References:

Blomberg, H., & Dempsey, M. (2011). *Movements that heal*. Queensland: Book Pal.

Goddard, S. (1996). *A teacher's window into the child's mind*. Eugene, OR: Fern Ridge Press.

Konicarova, J., & Bob, P. (2013). Asymmetric tonic neck reflex and symptoms of attention deficit and hyperactivity disorder in children. *International Journal of Neuroscience*, 123(11), 766-769. doi:10.3109/00207454.2013.801471

Assessment Resources Map – Mathematics

Age (years)	5	6	7	8	9	10	11	12	13	14	
Year Level	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	
Curriculum level	Level 1			Level 2		Level 3		Level 4		Level 5	
National Standards	The National Standards illustrate the mathematics knowledge and skills that students need to have developed at specific points in their schooling if they are to engage with the texts and tasks of the curriculum and make the expected progress. National Standards illustrations are used to help make Overall Teacher Judgments (OTJs).										
PaCT - Progress and Consistency Tool	After 1 year at school	After 2 years at school	After 3 years at school	End of Year 4	End of Year 5	End of Year 6	End of Year 7	End of Year 8			
Expected numeracy stages	1, 2 & 3 Counting All	Stage 4: Advanced Counting	Stage 5: Early Additive		Stage 6: Advanced Additive	Stage 7: Advanced Multiplicative		Stage 8: Advanced Proportional			
Numeracy Development Projects*	NumPA				Numeracy Project Assessment (Diagnostic Interview)						
	GloSS				Te Uuii Aromatawai						
					Global Strategy Stage Assessment (GloSS)						
	IKAN				Āpithanga Uuii Rautaki						
Numeracy Development Projects*	JAM	Junior Assessment of Mathematics (JAM)									
		He Uuii Aromatawai Tōmua i te Pāngarau									
	ARBS	Assessment Resource Banks (ARBS) are a collection of classroom assessment resources for students working at curriculum levels 1 – 6 in mathematics.									
	e-asTTle Maths				1389	1430	1466	1500	1535	1567	1601
Other Tools	NMSSA				The National Monitoring Study of Student Achievement tests students in years 4 and 8. NMSSA reports give useful information about national levels of student achievement and areas of difficulty.						
					NMSSA Maths		NMSSA Maths				
	PAT: Mathematics 2 nd Edition (2009)				Scaled score (patm) means calculated at year end. Supplementary tests align with expected progress at the beginning of the year.						
					30.6	38.9	45.1	49.6	55.0	60.6	65.4
NZ Curriculum Exemplars	These are exemplars of mathematical tasks used to support teaching and learning (Levels 1 – 5). Be aware that these exemplars, while still useful, relate to the curriculum levels and achievement objectives in the five strands set out in Mathematics in the NZ Curriculum, 1992. These, and the progressions of learning described, may not correspond with those described in the 2007 New Zealand Curriculum nor successive curriculum descriptors such as the LLPs or the National Standards.										
NZC Exemplars for Learners with Special Education Needs	Exemplars of work for students who are expected to learn long-term within Level One of the New Zealand Curriculum.										

Notes:

- Shaded regions indicate levels out of range of the tool
- Mean scores have been given for some tools. Be aware that a mean score does not necessarily correlate with the National Standard expectation. When using a normed tool to assist with making an OTJ, teachers should refer to the Alignment of Assessment Tools with National Standards pages on Assessment Online and to cut scores for the tools where available.
- The map should be read in combination with the Assessment Tool Selector in order to determine whether a tool is fit for purpose.
- Inclusion of a tool in this resource map does not indicate endorsement by the Ministry of Education.
- The map is not intended to limit a school's choice of tool.

Appendix Tr

Notes:

- Shaded regions indicate levels out of range of the tool
- Mean scores have been given for some tools. Be aware that a mean score does not necessarily correlate with the National Standard expectation. When using a normed tool to assist with making an OTJ, teachers should refer to the Alignment of Assessment Tools with National Standards pages on Assessment Online and to cut scores for the tools where available.

Assessment Resources Maps – Reading – updated April 2016

Assessment Resources Map – Writing – English medium

Age (years)	5	6	7	8	9	10	11	12	13	14
Year Level	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Curriculum level	Level 1			Level 2		Level 3		Level 4		Level 5
National Standards	The National Standards illustrate the writing knowledge and skills that students need to have developed at specific points in their schooling if they are to engage with the texts and tasks of the curriculum and make the expected progress. National Standards illustrations are used to help make Overall Teacher Judgments (OTJs).									
Progress and Consistency Tool (PaCT)	After 1 year at school	After 2 years at school	After 3 years at school	End of Year 4	End of Year 5	End of Year 6	End of Year 7	End of Year 8		
e-asTTle Writing	Learning progression frameworks that break down the aspects of writing and illustrate the stages of learning. The frameworks are aligned to the NZC and reflect the emphases of the National Standards.									
	The PaCT tool captures teacher judgments on aspects of writing and recommends an overall judgment (OTJ) that a teacher confirms or reviews.									
Assessment Tools	e-asTTle Writing - Mean scores (aWts) at year end									
	1091	1249	1342	1407	1458	1500	1535	1566	1593	1617
	Assessment Resource Banks (ARBs) are a collection of classroom assessment resources for students working at curriculum levels 1 – 5 in writing.									
NMSSA				NMSSA Writing		NMSSA Writing				
Observation Survey of Early Literacy Achievement – Revised Third Edition										
SSpA -Supplementary Spelling Assessment Years 4 – 6	SSpA is a NZ-based tool. Other spelling assessments are available to schools, although not of NZ origin. See the Assessment Tool Selector for details.									
				Mean scale scores by year level		34		39		44

Additional resources available to support teaching of writing

The assessment tools described above can all be used to support the teaching of writing.										
Age (years)	5	6	7	8	9	10	11	12	13	14
Year Level	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Curriculum level	Level 1			Level 2		Level 3		Level 4		Level 5
Resources	The Literacy Learning Progressions describe the writing knowledge and skills that students need to have developed at specific points in their schooling if they are to engage with the texts and tasks of the curriculum and make the expected progress.									
	<i>The English Language Learning Progressions</i> (ELLP) explain what ESOL specialists and mainstream teachers need to know about writing as part of English language learning. They will help teachers to choose writing content, vocabulary, and tasks that are appropriate to each learner's age, stage, and language-learning needs.									
	These are models of effective writing used to support teaching and learning (Levels 1 – 5). Be aware that these exemplars, while still useful, relate to the curriculum levels and achievement objectives described in the previous New Zealand Curriculum, published in 1994. These, and the progressions of learning described, may not correspond with those described in the 2007 New Zealand Curriculum nor successive curriculum descriptors such as the LLPs or the National Standards.									
	Exemplars of work for students who are expected to learn long-term within Level One of the New Zealand Curriculum.									
	<u>This resource on Literacy Online</u> will help strengthen knowledge and skills for teaching writing in years 1-8. It has 3 parts – for years 1-3, 4-6, and 7-8									
	</									

Notes:

- Shaded regions indicate levels out of range of the tool
- Mean scores have been given for some tools. Be aware that a mean score does not necessarily correlate with the National Standard expectation. When using a normed tool to assist with making an OTJ, teachers should refer to the *Alignment of Assessment Tools with National Standards* pages on Assessment Online and to cut scores for the tools where available.
- The map should be read in combination with the *Assessment Tool Selector* in order to determine whether a tool is fit for purpose.
- Inclusion of a tool in this resource map does not indicate endorsement by the Ministry of Education.
- The map is not intended to limit a school's choice of tool.

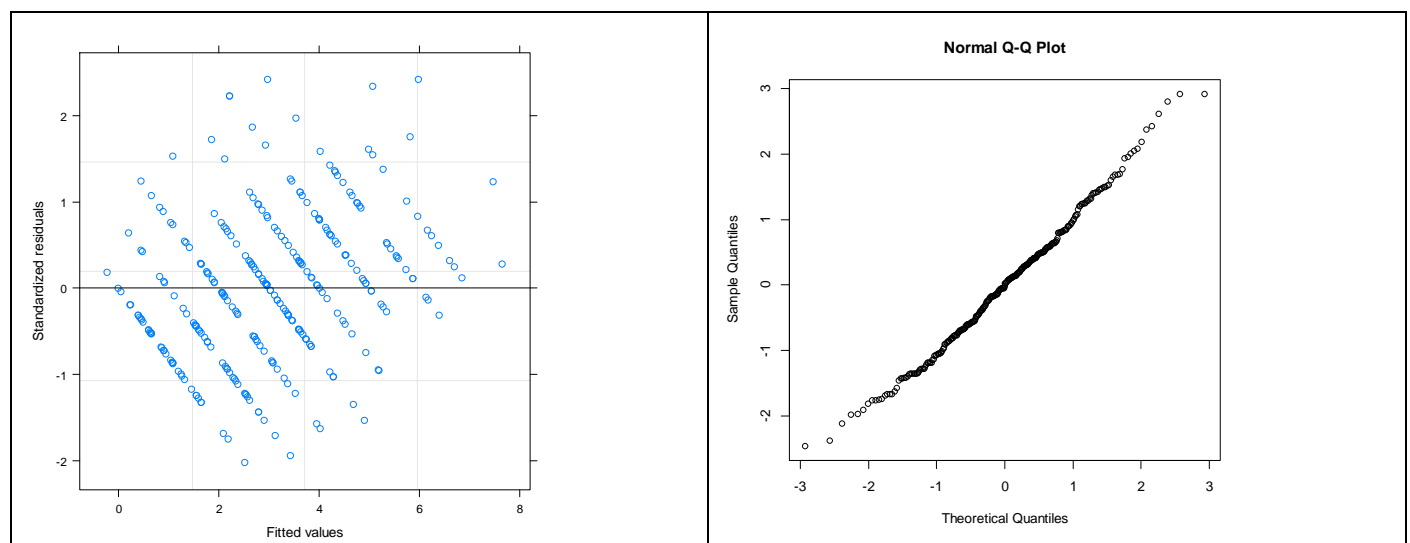
Appendix U

Linear Mixed-Effects Model – Tessa Grigg PhD research

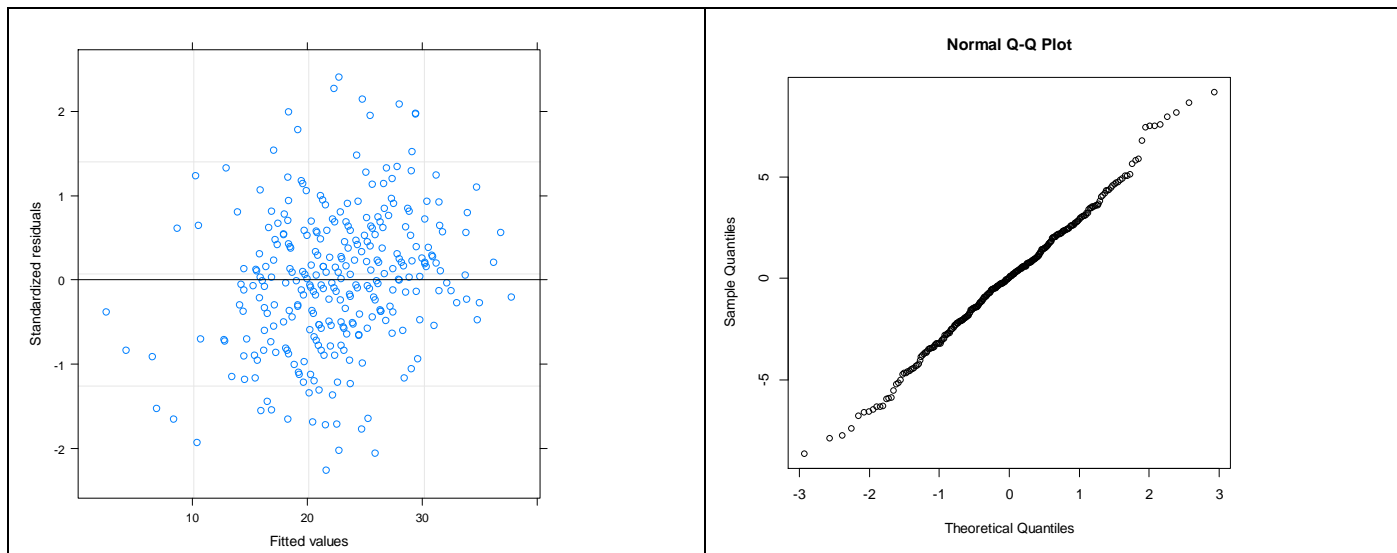
Model 1 Group	Is the response of a child predicted by time and group when completing the RMT intervention? $Response = \alpha + \beta \times Group + \gamma \times Days + \delta \times (Days \times Group)$ 0 = Control 1 = Intervention
	α = Expected response for the Control Group at Day 0 β = Expected difference in response of the Intervention vs Control Group at Day 0 γ = Expected effect of adding a day to the control group δ = Expected difference in the effect of adding days for Intervention and Control Groups Group = Control Group or Intervention Group Response variables: Reflex profile, DAP Scores, Reading Scores, Writing Scores, Mathematics Scores, SDQ scores.
Model 2 Frequency	Is the response of a child predicted by time and frequency when completing the RMT intervention? $Response = \alpha + \beta \times Frequency + \gamma \times Days + \delta \times (Days \times Frequency)$ 0 = ≥ 4 /per week 1 = < 4 / week
	α = Expected response for the $\geq \frac{4}{week}$ Group at Day 0 β = Expected difference in response of the $< \frac{4}{week}$ and $\geq \frac{4}{week}$ Groups at Day 0 γ = Expected effect of adding a day to the $\geq \frac{4}{week}$ Group δ = Expected difference in the effect of adding days for $< \frac{4}{week}$ and $\geq \frac{4}{week}$ Groups Frequency = ≥ 4 repetitions per week or < 4 repetitions per week Response variables: Reflex profile, DAP Scores, Reading Scores, Writing Scores, Mathematics Scores, SDQ scores.
	Both models had gender added as a control variable when Reflex profile was the response variable.

Scatter plots of predicted and residual values as well as Q_Q plots are presented to confirm that statistical assumptions have been met.

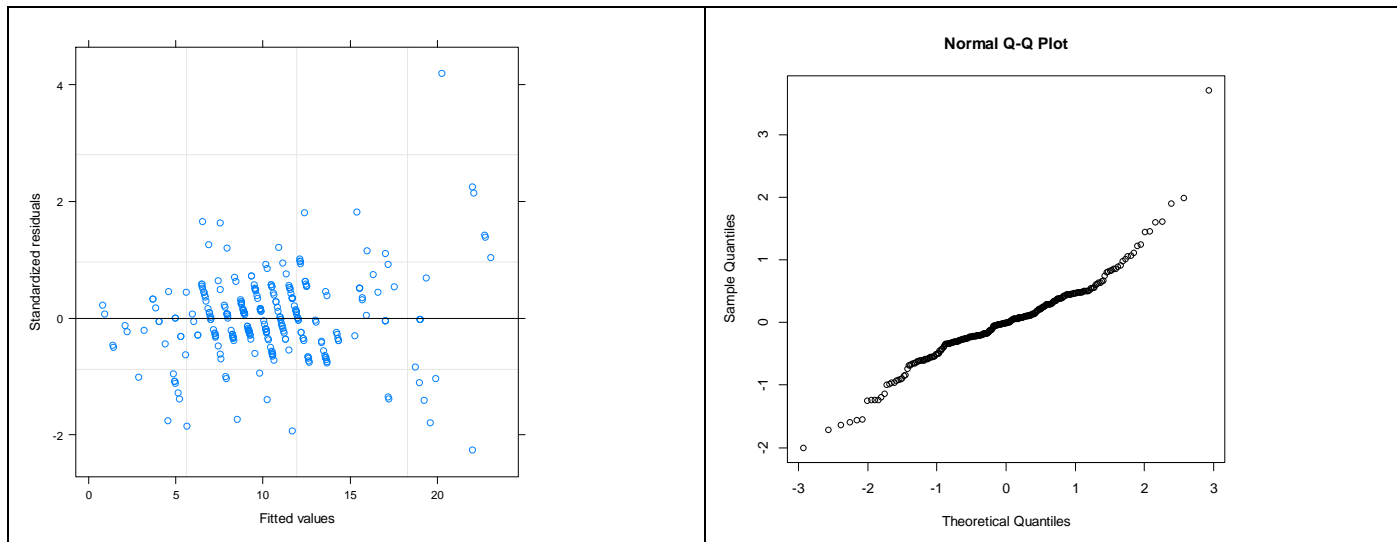
Reflex Profile



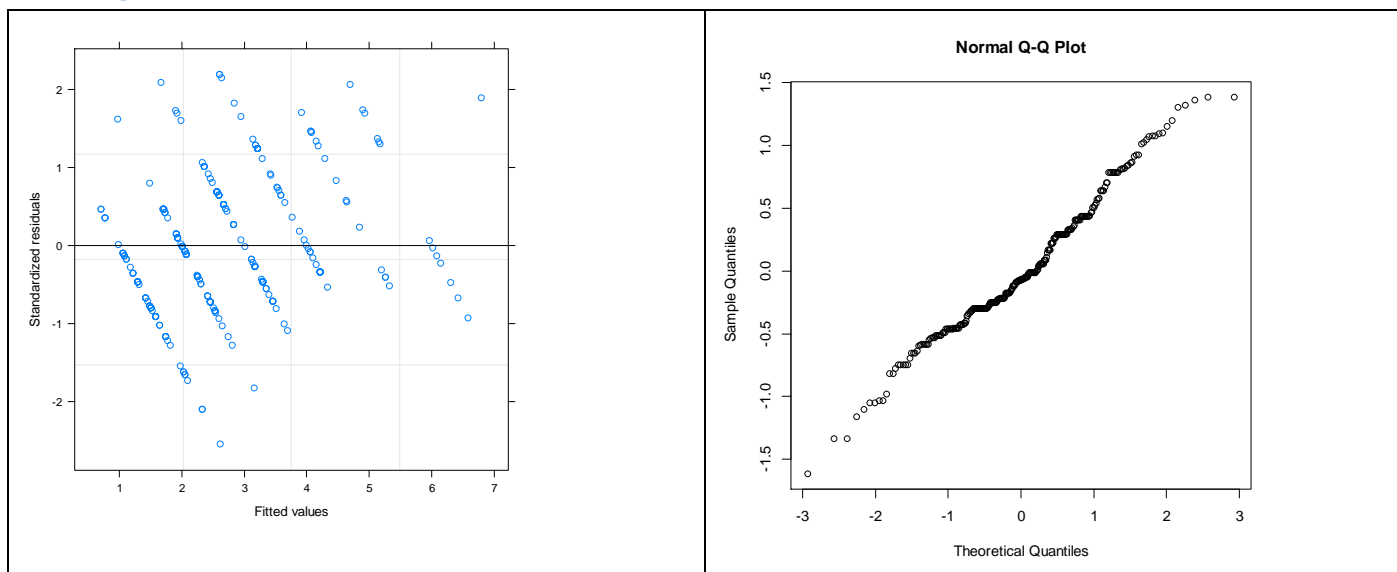
Draw-A-Person

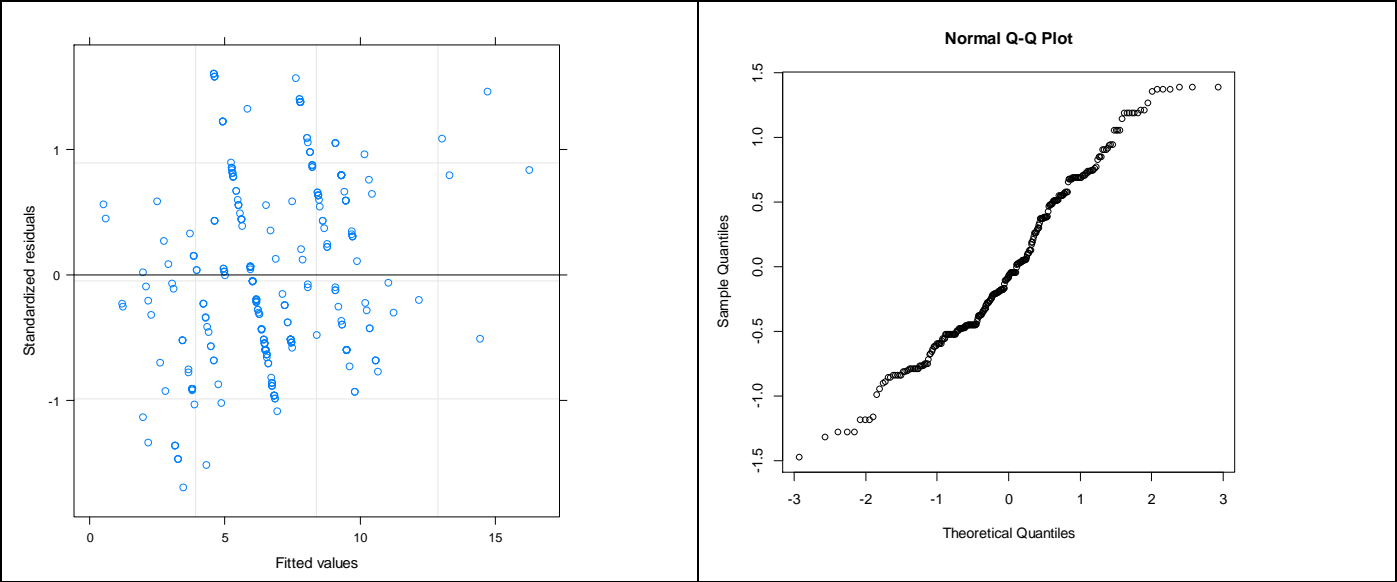


Reading

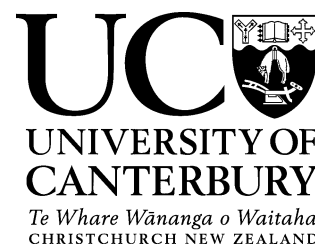


Writing





Appendix V



HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2016/63/ERHEC Amendment 3

21 June 2017

Tessa M. Grigg
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Tessa

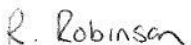
Thank you for your request for an amendment to your research proposal “What Influences does the Use of Rhythmic Movement Training (RMT) have on Student Achievement and Behavioural Outcomes?” as outlined in your email dated 7th June 2017. I am pleased to advise that this amendment has been considered and approved by the Educational Research Human Ethics Committee.

Please note that should circumstances relevant to this current application change you are required to reapply for ethical approval.

If you have any questions regarding this approval, please advise.

We wish you well for your continuing research.

Yours sincerely

PP 

Dr Patrick Shepherd
Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S

Health and Safety Guidelines - Hazard Matrix for Tessa Grigg – PhD Research in Schools

- It is my responsibility to familiarise myself with the school safety policies, through safety notices and liaison with the teacher regarding student safety.
- Before each focus-group interview session ensure that parents receive a safety briefing.
- Be mindful of the health and safety of the participants during the interviews.
- Keep a roll at each focus-group interview session so that if evacuation is necessary, participants can be checked off.
- I will communicate with my senior supervisor to confirm that I have read the school Health and Safety policies.
- I have a current First Aid certificate and while I have Police Clearance for school, the UC Police Clearance process is underway and will be completed before I begin my research. I will always wear my UC name badge when in the schools.

	Hazard	Uncontrolled Probability	Uncontrolled Outcome	Eliminate E Isolate I Control C	Control Measures	Controlled Probability	Controlled Outcome
1	Trips and falls	Medium	Minor injury	C	Educate through information about room	Low	Minor injury
2	Medical emergency	Medium	Major injury	C	Educate through information. ABC. Researcher has a current First Aid Certificate. Call 111 if medical assistance needed.	Low	
3	Aggression (Physical/verbal)	High	Major Injury	C, I	Remove self and others if possible. Call police. Note everything that was observed.	Low	
4	Power Outage	Medium	Minor injury	C	Educate through information.	Low	Minor injury
5	Earthquake	Medium	Injury	C	Educate through information, give instructions about earthquake procedures.	Low	Minor injury
6	Fire	High	Major injury/death	C	Educate through information about room, including fire exits and location of fire extinguisher. Activate fire alarm if necessary. Close doors. Evacuate. Call 111.	Low	Minor Injury
7	Flooding/storm/gale	High	Minor injuries	C	Evacuate to a safe place if possible. Switch off electrical equipment. Move equipment and valuables if there is time.		
8	Evacuation	Medium	Minor injury	C	Remain calm, leave building through safest exit. Check on roll that all participants have left the building.		

Appendix Xa

Researcher: Tessa M Grigg

tessa.grigg@pg.canterbury.ac.nz

Tel: 0274 774 825

Date: 1 November 2016	College/Department – Health Sciences
Principal Investigator: Tessa Grigg Associate Investigators: Nil Cultural Advisors, if any: Nil Please note if you have sought advice from NTRC, or other mana whenua representatives: No	
Project Title: What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?	
Concise description in lay terms of the proposed project, including brief methodology (up to 1 page): Purpose: Investigate the effects of Rhythmic Movement Training (RMT), with the voice of the teacher and parents being recorded. Retained primitive reflexes (reflexes that are useful for a baby, but not helpful in a classroom) are an issue for approximately 48% of children, with research (McPhillips & Jordan-Black, 2007) showing rates of retention rising to 70% in groups of children with learning challenges. The proposed study would be classroom based, mixed methods, involving 3 classrooms from 3 schools in Christchurch. Parents would complete an on-line questionnaire pre - and post - intervention and there will be three focus group interviews for a randomly selected group of parents to attend. Teachers will also be interviewed about the implementation of the programme. The children would be assessed for their range of reflex integration, and results from their NZ National standard testing will be accessed to measure the rate of academic development. The children would be divided into two groups and complete an eight month, or four month programme of exercises, ie multiple base-line study. Talking to parents of the children in the study is new information as in all reflex integration intervention studies completed to date the parent voice has been missing and their insights would provide interesting information about effectiveness of RMT. RMT has not attracted any empirical research to-date. McPhillips, M., & Jordan-Black, J. (2007). Primary reflex persistence in children with reading difficulties (dyslexia): A cross-sectional study. <i>Neuropsychologia</i> , 45(4), 748-754. doi:10.1016/j.neuropsychologia.2006.08.005	
Does the proposed research involve any of the following? Please underline. <ul style="list-style-type: none">• Significant Māori content• Access to Māori sites• Sampling of native flora/fauna• Culturally sensitive material/knowledge• <u>Māori involvement as participants or subjects</u>• Research where Māori data is sought and analysed• <u>Research that will impact on Māori</u>	

If you have underlined any of the above, please explain in more detail:

Is there a possibility that there will be Māori participants? *Yes, there is a possibility that within the school classes there will be Māori students.*

How will you identify Māori participants throughout your research? *Through existing school data.*

What processes and procedures will you have in place if there are Māori participants in your research?

Parents are being asked to give informed consent prior to their children starting the intervention exercises. An informal information evening is being offered so that parents can talk about the implications for their child if the child participates in the study. In selecting the exercises for the study, sensitivity towards iwi Māori was considered.

If there are Māori students, and if those Māori students have retained reflexes, there is a possibility that their student achievement and behavioural outcomes may improve. This would positively impact on their future progress. This problem of retained primitive reflexes has not been related to any specific cultural group, it is a generalised population issue. The current study is not investigating the representation of any particular group in the reflex statistics. Ethnicity is being identified, but only to attempt to match the treatment groups evenly.

Ngāi Tahu Consultation and Engagement Group



Appendix Xb

10/01/2017

Tēnā koe, Tessa

Re: What influences does the use of Rhythmic Movement Training (RMT) have on student achievement and behavioural outcomes?

This letter is written on behalf of the Ngāi Tahu Consultation and Engagement Group. I have read and considered your proposal and acknowledge that this is a worthwhile and interesting project.

It is well considered and the researcher is clear about how they ought to take participants' (cultural) needs into account.

Thank you for engaging with the Māori consultation process. This will strengthen your research proposal, support the University's Strategy for Māori Development, and increase the likelihood of success with external engagement. It will also increase the likelihood that the outcomes of your research will be of benefit to Māori communities. We wish you all the best with your current project and look forward to hearing about future research plans.

The Ngāi Tahu Consultation and Engagement Group would appreciate a summary of your findings on completion of the current project. Please feel free to contact me if you have any questions.

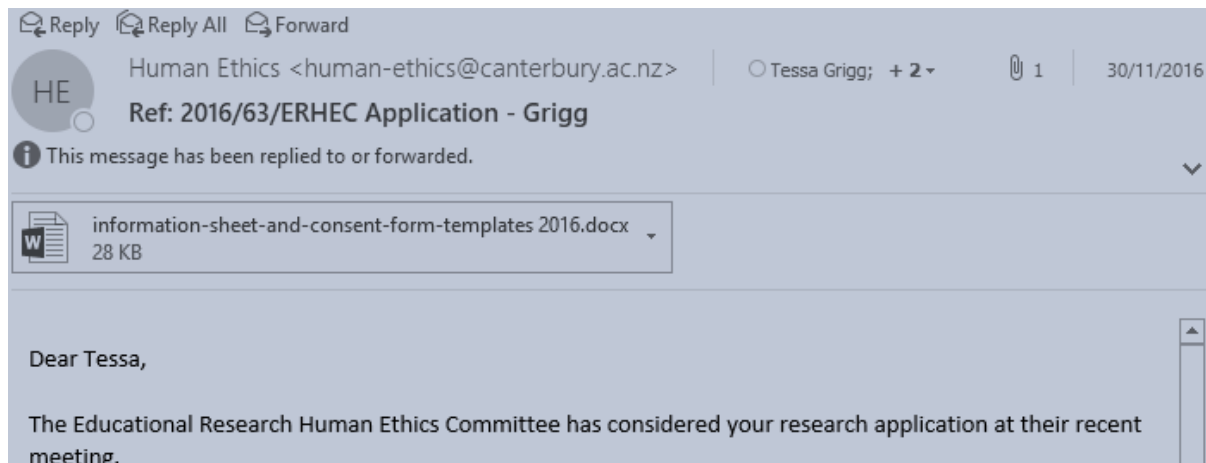
Ngā mihi
Nigel Harris

A handwritten signature in dark ink, appearing to read 'Nigel Harris'.

Kaiārahi Māori Research
Research and Innovation
Te Whare Wānanga o Waitaha
Private Bag 4800
Otautahi Christchurch 8140
Aotearoa New Zealand

Phone +64 3 364 2987 ext 45520/6120 cell 0273950134 nigel.harris@canterbury.ac.nz

Appendix Ya – ERHEC first email reply to Ethics approval application; dated 30/11/16



Dear Tessa,

The Educational Research Human Ethics Committee has considered your research application at their recent meeting.

Following discussion, the Committee felt that there were one or two areas in your application that required revision and/or clarification before they could give their approval. To assist them further in their deliberations I will be grateful if you could provide the following information:

- Where will the raw data be stored?
- The Committee felt that potential risks were not addressed sufficiently. The parents will fill out a strengths and difficulties questionnaire about their children. Please could you discuss what you will do if a problem is identified, and what you will do if a parent becomes upset after filling in the form?
- Regarding the focus group – the Committee wondered if parents would be willing to share details about their child in this kind of forum. Please note that the participants in the focus group need to agree to confidentiality – this can be in either written or verbal form.
- Please personalise the Information Sheet for the teacher so that it reads “you” and not “your school”.
- The Child’s Information Sheet doesn’t mention that they will be tested, nor that they will be observed/videoed. Please can you add this information. Please remove the statement that the “parents have agreed to the study”, as this can be seen as coercion. Rather than talking the children through the form, please add all the information necessary to the form and allow another person to read the information to the children.
- Please can you condense the information in the Consent Form, as it is currently too long. A template is attached for your convenience.
- In the Information Sheet, under measures, please could you explain why the children are asked to draw a figure? Please also omit the “jargon” from this section to make it easier to read. Please also condense this information as it is currently too long at four pages.
- Please could you clarify whether participants will receive copy of the report or a copy of your PhD. Please note that a summary of results will be made available, but this could be some time later (e.g. at the end of the PhD). Perhaps a presentation of the results could be sufficient?
- Please provide a Stamped Addressed Envelope for participants to return the form, don’t assume that they can use/have access to a scanner.

Following amendment I would be pleased to receive your revised documentation for further review. **Please detail how you have addressed each point of the Committee's feedback**, and amend your application and/or supporting documents accordingly. Please forward these documents to the above email address quoting the ERHEC reference number in the subject line.

Please note that you should not begin your project until you have received a formal letter of approval from the Chair of the Educational Research Human Ethics Committee.

Kind Regards,

Rebecca Robinson

Ethics Coordinator and Erskine Programme Administrator

Level 5 South, Matariki Building

University of Canterbury ~ Te Whare Wānanga o Waitaha

Private Bag 4800, Christchurch 8140, New Zealand

Ph: +64 3 369 4588, Ext: 94588

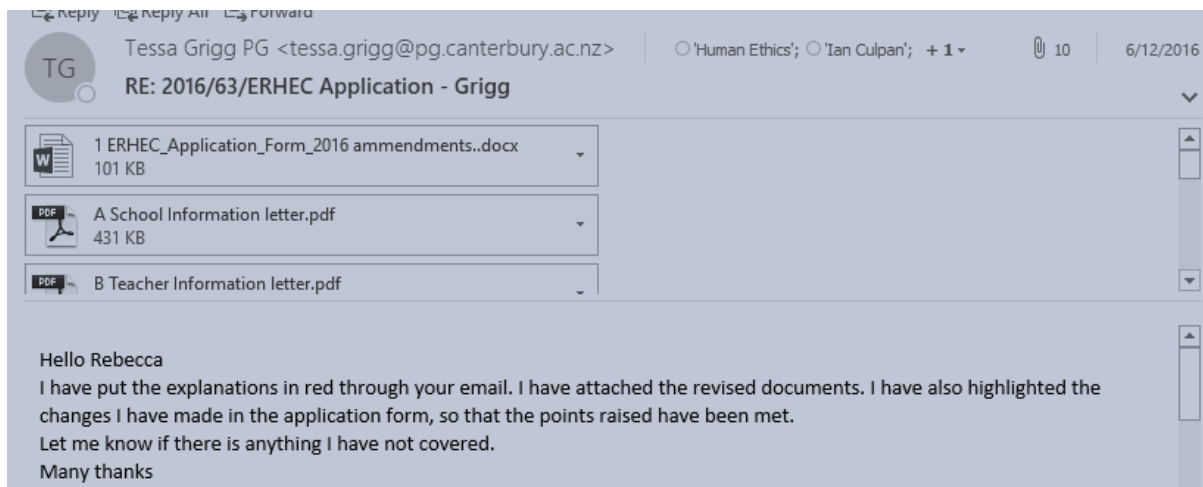
Email: human-ethics@canterbury.ac.nz

Ethics hours of work: Mon 2.30-5pm, Tues 8.30-11am, Wed 8.30-5pm, Thu 2.30-5pm, Fri 8.30-5pm



Please consider the environment before printing this e-mail

Appendix Yb – Researchers reply to ERHEC’s initial ethics approval email; dated 6/12/16



Hello Rebecca

I have put the explanations in red through your email. I have attached the revised documents. I have also highlighted the changes I have made in the application form, so that the points raised have been met.

Let me know if there is anything I have not covered.

Many thanks

Tessa

Tessa M Grigg

Post Graduate

University of Canterbury, New Zealand

email: tessa.grigg@pg.canterbury.ac.nz

mobile: 027 477 4825

From: Human Ethics [<mailto:human-ethics@canterbury.ac.nz>]

Sent: Wednesday, 30 November 2016 9:54 AM

To: Tessa Grigg <tessa.grigg@pg.canterbury.ac.nz>

Cc: Ian Culpán <ian.culpán@canterbury.ac.nz>; Wendy Fox-Turnbull <wendy.fox-turnbull@canterbury.ac.nz>

Subject: Ref: 2016/63/ERHEC Application - Grigg

Dear Tessa,

The Educational Research Human Ethics Committee has considered your research application at their recent meeting.

Following discussion, the Committee felt that there were one or two areas in your application that required revision and/or clarification before they could give their approval. To assist them further in their deliberations I will be grateful if you could provide the following information:

- Where will the raw data be stored? **On the secure server at the University – P Drive. I have a university computer (thank you) and the data will be stored through that.**
- The Committee felt that potential risks were not addressed sufficiently. **This has been added to each information letter.** The parents will fill out a strengths and difficulties questionnaire about their children. Please could you discuss what you will do if a problem is identified, and

what you will do if a parent becomes upset after filling in the form? Thanks for pointing this out, of course it is possibly a problem. I will check with each school as to what systems they have in place to support parents. This may include an RTLB teacher, the classroom teacher, and having a list of community based support people. This list can not be compiled until I know the area of the school and what existing systems they have in place.

- Regarding the focus group – the Committee wondered if parents would be willing to share details about their child in this kind of forum. Please note that the participants in the focus group need to agree to confidentiality – this can be in either written or verbal form. Thank you – I have added the confidentiality agreement statement to the semi-formal focus-group Interview sheet (attached). Regarding them sharing information, I believe that any sensitive information will be put through the questionnaire. These parents know each other as each interview will only have people from their school. From my experience parents are usually happy to talk about their child in a group. Also participation in this focus group is voluntary so parents who are not comfortable talking in a group setting do not need to sign up for this. From the 24ish parents in the class only 8 will be interviewed.
- Please personalise the Information Sheet for the teacher so that it reads “you” and not “your school”. I have fixed this – attached.
- The Child’s Information Sheet doesn’t mention that they will be tested, nor that they will be observed/videoed. Please can you add this information. I have done this. Please remove the statement that the “parents have agreed to the study”, as this can be seen as coercion. I have done this. Rather than talking the children through the form, please add all the information necessary to the form and allow another person to read the information to the children. I have done this.
- Please can you condense the information in the Consent Form, as it is currently too long. A template is attached for your convenience. All four consent forms amended and attached.
- In the Information Sheet, under measures, please could you explain why the children are asked to draw a figure? Please also omit the “jargon” from this section to make it easier to read. Please also condense this information as it is currently too long at four pages. All four information sheets amended and attached
- Please could you clarify whether participants will receive copy of the report or a copy of your PhD. Please note that a summary of results will be made available, but this could be some time later (e.g. at the end of the PhD). Perhaps a presentation of the results could be sufficient? I believe that busy parents would prefer a report – 80,000 words would be a challenge for most. However they are welcome to read the full PhD if they choose. I have this information on the consent forms.
- Please provide a Stamped Addressed Envelope for participants to return the form, don’t assume that they can use/have access to a scanner. I have put this on the consent forms.

Following amendment I would be pleased to receive your revised documentation for further review. **Please detail how you have addressed each point of the Committee’s feedback**, and amend your application and/or supporting documents accordingly. Please forward these documents to the above email address quoting the ERHEC reference number in the subject line.

Please note that you should not begin your project until you have received a formal letter of approval from the Chair of the Educational Research Human Ethics Committee.

Kind Regards,

Rebecca Robinson

Ethics Coordinator and Erskine Programme Administrator
Level 5 South, Matariki Building

University of Canterbury ~ Te Whare Wānanga o Waitaha

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Ph: +64 3 369 4588, Ext: 94588

Email: human-ethics@canterbury.ac.nz

Ethics hours of work: Mon 2.30-5pm, Tues 8.30-11am, Wed 8.30-5pm, Thu 2.30-5pm, Fri 8.30-5pm



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Appendix Yc – ERHEC second email reply to Ethics approval application; dated – 9/12/16



Dear Tessa,

Many thanks for sending through your revised documents and response to the Committee's questions.

The Committee felt there were still a couple of things they would like you to address before they can give approval to your project:

- **Risks:** the Committee felt that there were psychological risks to the children involved that have yet to be addressed. The children are doing these movements together - some will be more co-ordinated than others, some will quickly grasp the movements, others may struggle. What about children that may have a physical impairment that makes these movements difficult? How will these be managed so that children do not feel inadequate, belittled, etc.?
- **Information Sheets:** please could you change the order of these so that the group that each Information Sheet is for is in the first section, i.e. the Parents' Sheet needs to have what children/parents need to know first, not the school information.
 - The Committee also felt that the wording of the sheets should be amended, as it is currently too directive e.g. "you will". The person reading the sheet has not agreed to be a participant yet. The Committee suggest the wording be changed to "you will be asked to....".
 - The BOT and Principal sheets state "I would need access to one...", a better way to request this might be "I would be seeking access to one...". The Committee also suggest changing the phrasing along similar lines in the statements under the "testing" heading.
 - Please re-word the statement around withdrawing from the project so it is adapted to/relates to the information for the BOT and Principal.

Following amendment I would be pleased to receive your revised documentation for further review. **Please detail how you have addressed each point of the Committee's feedback**, and amend your application and/or supporting documents accordingly. Please forward these documents to the above email address quoting the ERHEC reference number in the subject line.

Please note that you should not begin your project until you have received a formal letter of approval from the Chair of the Educational Research Human Ethics Committee.

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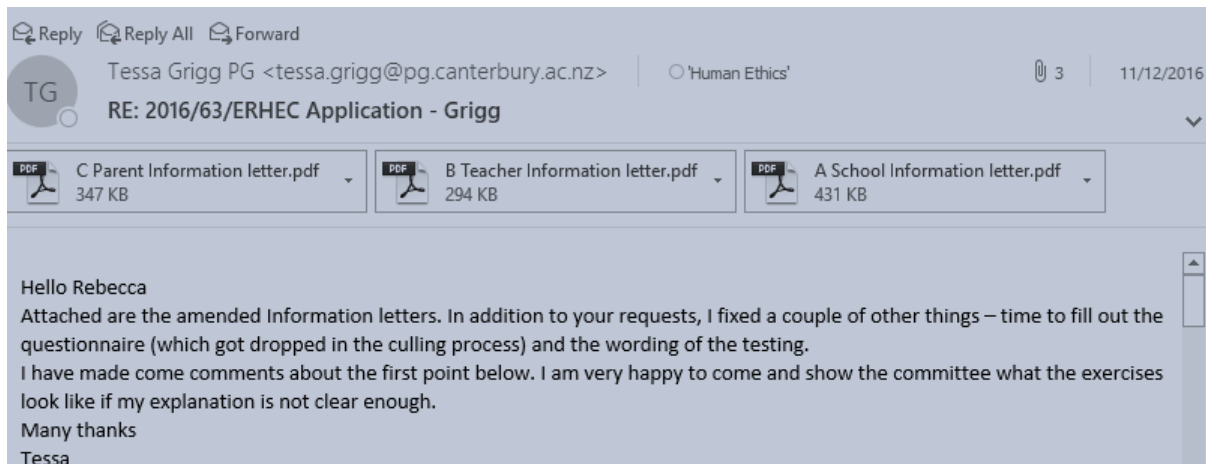
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Appendix Yd – Reply to second ERHEC letter



Hello Rebecca

Attached are the amended Information letters. In addition to your requests, I fixed a couple of other things – time to fill out the questionnaire (which got dropped in the culling process) and the wording of the testing.

I have made come comments about the first point below. I am very happy to come and show the committee what the exercises look like if my explanation is not clear enough.

Many thanks

Tessa

*Tessa M Grigg
Post Graduate*

*University of Canterbury, New Zealand
email: tessa.grigg@pg.canterbury.ac.nz
mobile: 027 477 4825*

From: Human Ethics [<mailto:human-ethics@canterbury.ac.nz>]

Sent: Friday, 9 December 2016 8:43 AM

To: Tessa Grigg <tessa.grigg@pg.canterbury.ac.nz>

Cc: Ian Culpan <ian.culpan@canterbury.ac.nz>; Wendy Fox-Turnbull <wendy.fox-turnbull@canterbury.ac.nz>

Subject: RE: 2016/63/ERHEC Application - Grigg

Dear Tessa,

Many thanks for sending through your revised documents and response to the Committee's questions.

The Committee felt there were still a couple of things they would like you to address before they can give approval to your project:

- **Risks:** the Committee felt that there were psychological risks to the children involved that have yet to be addressed. The children are doing these movements together - some will be more co-ordinated than others, some will quickly grasp the movements, others may struggle. The children are lying down to do most of the exercises so they can not see 'who can' and 'who can't' complete the exercises. All of the exercises I have chosen have a passive option so that if a child is struggling an adult can help them to get the movement going. I have this operating in a classroom at the moment (where I was teaching) and there have been no issues from a competitive nature – "I can do this and you can't". This is in part due to the teacher's encouraging approach and I would expect that from a professional teacher. Of course I will be encouraging the teacher to accept whatever the child can manage, knowing that with time their skill level will improve (this has been very evident with the children than are already doing it). I see this short exercise session being far less psychologically detrimental than a Maths test with marks, or a running race where the winners and losers are obvious. Once the exercises have been taught, the children then choose the exercise they feel they need, or that they like. Again with everyone doing different exercises the comparisons are harder for children to make. In the class that has been doing the exercises the teacher has been fascinated by what each child has chosen. The less skilled children find the exercise that is easiest for them and they stick with that for a while, and then they change it. The well skilled children change their exercise more often. This will all have implications for the discussion section of the thesis. What about children that may have a physical impairment that makes these movements difficult? The exercises are simple and there are adaptations that can be made. In Sweden the exercises have been used with a range of children with quite marked physical, and cognitive impairments. At the beginning the movement the child can complete may be rudimentary, but as the brain connections grow the movement becomes more mature. I believe I have the experience to be able to work through any issue of this nature and adapt the exercise to meet the needs of the child. How will these be managed so that children do not feel inadequate, belittled, etc.? I have a birth injury (arm/shoulder) of my own and I have been able to make the exercises work. It will never be about what the child can't do, but rather about what they can do. This is the whole basis of this programme and I will be encouraging teachers along these lines. There is not a right and wrong way to complete the exercise, it is about how it feels for the child, and I will teach the teachers to ask the children "How does that feel for you, would it be better to go faster? Or slower? Does a bigger movement feel better or a smaller one? The child is in control of what is happening. From my experience over the two years using these exercises with children, they seem to know what they need, and they gain a real sense of achievement when they can complete the exercises. I have had experience with a parent trying to get her child to complete the exercise 'correctly', and the child being very annoyed, so I now spend more time with the parent watching me gently working with the child, accepting what they can do, and leaving it at that. I do show the child what the correct exercise looks like, but do not tell them that they are not doing it correctly. Caring for the child and how they feel is very important to me. To have willing participators, I need to provide a supportive and encouraging environment. I believe that with my 30+ years of teaching experience I can provide that environment.

- **Information Sheets:** please could you change the order of these so that the group that each Information Sheet is for is in the first section, i.e. the Parents' Sheet needs to have what children/parents need to know first, not the school information.
 - The Committee also felt that the wording of the sheets should be amended, as it is currently too directive e.g. "you will". The person reading the sheet has not agreed to be a participant yet. The Committee suggest the wording be changed to "you will be asked to....".
 - The BOT and Principal sheets state "I would need access to one...", a better way to request this might be "I would be seeking access to one...". The Committee also suggest changing the phrasing along similar lines in the statements under the "testing" heading.
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Please note that you should not begin your project until you have received a formal letter of approval from the Chair of the Educational Research Human Ethics Committee.

Kind Regards,

Rebecca Robinson

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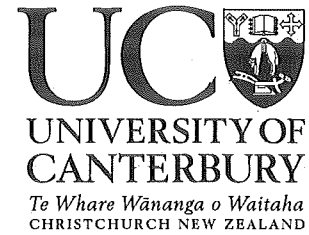
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Appendix Z



HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2016/63/ERHEC

14 December 2016

Tessa M. Grigg
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Tessa,

Thank you for providing the revised documents in support of your application to the Educational Research Human Ethics Committee. I am very pleased to inform you that your research proposal "What Influences does the Use of Rhythmic Movement Training (RMT) have on Student Achievement and Behavioural Outcomes?" has been granted ethical approval.

Please note that this approval is subject to the incorporation of the amendments you have provided in your emails of 6th and 11th December 2016.

Should circumstances relevant to this current application change you are required to reapply for ethical approval.

If you have any questions regarding this approval, please let me know.

We wish you well for your research.

Yours sincerely

pp *R. Robinson*

Patrick Shepherd
Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S